COLLECTION TRIPS

DEVIL'S HOLE

1967-68

Carol J. James

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Carol J. James

Measurements and Sex Determination

Adults { Males
Females

Juveniles – 10 to approx. 15 mm

This determination is variable. We have found that males acquire their first distinguishing external characteristics (elongated anal fin, black markings on dorsal and caudal fins, and over-all darker body color) from approximately 14-16 mm in total length. Since this varies with individuals, the category "Juveniles" is somewhat indefinite. In addition, it must be remembered that an individual will be designated a "female" usually only after this interval (14-16 mm) has been passed. This of course results in error in proportion of adult males to females because of the fact that males may be recognized when smaller in size.

Young – 9 mm and smaller

This "smaller" measurement decreases to a minimum of 5 mm. This size may be considered "new born" young.

CJJ 67-1

Carol J. James

Devil's Hole, Ash Meadows, Nye Co., Nevada

10 June 1967 1000 - 1545 DST
Carol James & Charles W. Ivy

OK

7 Pictures

Initial Observations:

Weather - clear Wind - gentle
General condition: Entire upper shelf bottom and rocks covered with green algae. Small portion of SW corner (where water depth is shallowest) is covered with floating algae. A light scum covers the entire water surface.

Activity -

At 1015, fair number of fish on shelf, ~75 individuals, decreasing with time. Males in breeding colors, some breeding activity, and small fish down to 5 mm present on the upper shelf. No territoriality observed - some schooling of fish. Individuals seem almost fearless but when sufficiently frightened swim over the shelf ledge and to the lower levels.

Other - Planaria very abundant - especially around floating algae. Four Say's Phoebe's were observed. One pair of which evedently have a nest above the hole and frequent the water area. Saromalus ? Uta stansburiana observed. Honey bees (a swarm about 1500 hrs.) frequenting mud at water's edge.

~~99~~
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Collection:

Trapping. Traps lined with 1/32 wire mesh.
No bait used.
Set according to map.
Total - 12 traps

1040 - 1240 hrs. Total trap hours = 24

Upper Shelf - 4 sinkers (see map)
4 floaters

Trap	Depth (ft.)	Number Captured	Measurements & Remarks (+ measured per trap)
[1]	3½	1	18 mm ♂
[2]	2	0	28 ♀
[3]	2½	0	20 ♂
[4]	2	3	16 ♂
			26 ♀
①	floater	0	13 juv.
②	"	0	7 juv.
③	"	2	
④	"	1	
		Total 7	

□ = sinker
○ = floater

Lower Shelf - Four sinkers were set in one connected line along the sloping shelf. The bottom trap was at the deepest level at that point (21'). The other traps were at 18, 12, + 3 ft depths. All depths taken - not length of line used. This is designated as Trapline 1, with traps a, b, c, & d ("d" being the deepest and "a" being nearest the surface.

cgg
67-1

Trap	Depth (ft.)	Number Captured		Measurements
Ia	3	0	not measured per trap	23 mm
Ib	12	0		20
Ic	18	2		14
Id	21	4		16
		Total 6		17
				20

Observations:

Total trapped = 13

No O_2 taken - instructions not in kit.

CO_2 - 6.0 ppm

pH - 8.15 (not adjusted)

Temperature - taken but probably inaccurate (tele thermometer)

1100 hrs - AIR Temp. = 82° F. (shade)

Water Temp. - Surface + 2' Depth = 91.5° F.

10' Depth = 94° F.

CGJ
67-1

Seining –

1300 to 1430 hrs.

Total of 52 fish captured. Mainly adults.
Many others at lower shelf.

Total C. diabolis captured and measured.

Males	9
Females	29
Unknown Adults	15
Juveniles	8
Young	4
Total	65

See Data Sheets for Breakdown of Size + Sex.

Malformities – (Included in all data)

All seined.

Female – 17 mm – Body constricted from anal fin back. "S"-shaped spine (dorsal view)

Female – 18 mm – Everted intestine and "S"-shaped spine (dorsal view)

Female – 19 mm – Malformed spine (side view)

cgg
67-1

Remarks -

Fish most active during first two hours we were there - 1000 - 1200 hrs. This time was followed by a period of decreased activity. Activity seems to decrease as sun rays fall directly on shelf.

CGJ 67-1

10 June 1967

Length Frequency

Length (mm)	Total	Males	Females	Unident. Adults*	Juveniles	Young
5	1					
6						
7	1					
8	1					
9	1					
10	1					
11	2					
12						
13	1				1	
14	2				1	
15	2					
16	3	1		1		
17	6			1		
18	6	1	1			
19	8	1				
20	7	1	1	1		
21	6					
22	4					
23	5	1		1		
24	1					
25	3					
26	2		1			
27						
28	2		1			
29	65	9	29	15	8	4
30						

Trapped

Collected by Seining + Other

* Determination of sex questionable. This will only be a significant figure until practice insures good sex determination. These will majorally be females.

CJD 67-1 Placement of Traps - 10 June 1967

□ sinkers
○ floaters

CJJ 67-2

Carol J. James

Devil's Hole, Ash Meadows, Nye Co., Nevada.

17 June 1967 0900 - 1500 hrs. DST
C. James & Vera James

Initial Observations:

Weather - clear
General Condition - Algae abundant. Floating algae at So. edge of upper shelf. Scum present until disturbed - shifts even when not disturbed.

Activity - 7100 on upper shelf at 0900 hrs. Many at surface - incl. both small adults and young. Larger adults stay mostly at bottom & around rocks. Young observed frequenting shallow southern edge of upper shelf.
Again - slight schooling. No territoriality. Some breeding activity (but very little) Planaria around floating algae. Also seen swimming in mid water (surface) & around rocks in deeper portions of upper shelf.

Collection -

Trapping: This time we decided to see if bait made any difference in number captured per trap, so two traps were set - about 1½' away from each other - in each instance, one baited, one not. Floaters & sinkers

1967-2

both were used where depth allowed to try sampling any difference in depth distribution. Dog food was used as bait. See map.
Traps with 1/32" wire mesh. Total traps - 18

Time: 1045 - 1315 hrs. 45 Trap hrs.

Upper Shelf - 6 sinkers
8 floaters

See map

Trap	Remarks	Number Captured	Remarks
1	Unbaited - sinker	4	1 br. male - 2 med. - sized + (1) 10mm
2	" floater	0	
3	" - sinker	0	
4	" "	1	20 mm
5	" "	0	
6	" "	0	
7B	Baited - floater	0	
8	Unbaited - floater	1	
1B	Baited - sinker	0	
2B	Baited - floater	0	
3B	Baited - sinker	0	
4B	" "	0	
5B	" "	0	
6B	" "	3	

cgg 67-2

Lower Shelf - One line of traps was set - trap "a" was a floater, trap "d" was at the shelf bottom - traps b & c as well as d had weights on them so they rested on the slope.

Trap	Depth (ft.)	Number Captured	Remarks
ALL Baited			
Ia	surface	5	All dead
b	12	0	
c	~18	1	13 mm
d	21	13	(incl. 6 males)

Observations:

Juveniles at so. end of shelf
Most fish on bottom shelf.

Cannabalism of 0+ fish caught in screen of 6B

1230 hrs. - Cl_2 (shade) 4.0 ppm
pH (shade 7.8
Temp.
AIR (shade) 32.5 °C
Surface (shade) 33.5 °C
Shelf Bottom (shade) 33.6 °C
O_2 3.55
O_2 saturated 3.8

1300 hrs. - Temp. & O_2 taken by placing probe in several different positions and taking readings. For readings on lower shelf, I stood on the upper shelf and placed the probe from that ledge.

CGJ 67-2

Position of Probe	Temp.	O_2
2' - Lower shelf bottom in shade	33.8°C	2.35
15' - Over Lower shelf in sun	33.5°C	3.22
5' - Over lower shelf in sun	33.5°C	3.2
2' - Upper Shelf in sun	33.5°C	4.1

1530 hrs. — O_2 2.8
O_2 sat. 3.5

Temp. - water 33.5°C
AIR 34.7°C

CO_2 (sun) 8
pH (sun) 8.45

No seining done, but I tried dipping with ½ traps and was able to collect some.
No distinction was made in measuring.

Total *C. diabolis* captured and measured - 36

cgg 67-2

Little sex distinction possible because of inexperience.

Breeding males recorded at

20 mm
18 mm
21 mm
26 mm
21 mm

For other measurements, see Data.

6 fish preserved in 10% Formalin
later transferred to alcohol
Included in data.

CJJ 67-2
17 June 1967

Total Length (mm)	Number of Individuals
9	2
10	1
11	4
12	
13	1
14	2
15	
16	3
17	4
18	2
19	2
20	5
21	2
22	5
23	
24	1
25	1
26	1
	36

CJJ
67-2 Placement of Traps - 17 June 1967

□ number
○ [illegible]
B - [illegible]

CJJ 67-3

Carol J James

Devil's Hole, Ash Meadows, Nye Co., Nevada.

21 June 1967 0600 - 1320 hrs. DST

C. James, S. James, & Jim Tener

Initial Observations:

Weather - clear Wind - gentle

General condition:

Floating algae present at SW edge

Algae on shelf in good condition.

Scum much reduced, esp. over algae and shelf.

Activity:

0905 hrs. - > 100 fish on shelf.

Very small (~5mm) fish seen in shady portions of shelf.

Attempted breeding observed on NE corner of shelf.

Groups of males together

Larger individuals seem to prefer deeper water.

Medium & small fish frequent surface.

Fairly inactive - random movement - stationary in algae & frequently hide in algae.

No territories observed

Collection:

Trapping. Traps lined with 1/32" wire mesh

No bait used.

Set according to map

Total - 17 traps.

CGG 67-3

0815 hrs. - 1015 hrs. Total Trap hrs. = 34

Upper Shelf - (1) sinker was placed where I thought it would trap as many individuals as possible. See map

Trap	Depth (ft.)	Number Captured
5	2½'	6

Lower Shelf - Four lines were set at selected places, with four traps in each line. See below for depths. Lines I, III, & IV were nearly vertical - Line II had weighted traps (except for floater), and rested against the western slope. Even "floater" of Line 4 (IV) was pulled beneath surface several feet - not enough traps to add another at this time.

Traplines designated as I, II, III, & IV. ("d" is lowest top trap; "a" is top)

Trap	Depth (ft.)	Number Captured
Ia	floater	0
Ib	floater	0
Ic	10'	0
Id	20'	5
IIa	floater	0
b	10	0
c	18	0
d	23	3

CJJ 67-3

Lower Shelf, con't

Trap	Depth (ft.)	Number Captured	
IIIa	floater	0	
b	10	0	
c	20	0	
d	26	1	small
IVa	15	0	
b	25	0	
c	35	0	
d	45	0	
		9 at Lower shelf	

Observations & Remarks -

Inner Tubes used to place traps and take measurements.

Difficulty in placing Trapline IV because of interference of slope - not allowing bottom trap to go to the 45' level.

Total trapped - (13) C. diabolis

0920 hrs. - Temp. 30.4°C - AIR
33.4°C - Surface
33.3°C - Shelf.
33.5°C - 45'
33.3-4°C - 27' Lower shelf

No light measurements - light meter not functioning well because of connection getting wet.

P_2 not taken — machine not regulated

CJJ 67-3

Seining -

1115 - 1200 hrs. & 1215 - 1230 hrs.

Total of 60 individuals seined. Mainly juveniles. Many others at lower shelf.

Seining on shelf. Larger individuals went over edge. After this, seining produced many small individuals.

But, 1215 - 1230 hrs. was more productive (perhaps because of more time allowed for fish to get on upper shelf after much human activity on shelf).

1300 hrs. — CO_2 8.0 ppm.

pH. 7.7

Sexual distinctions difficult to make due to lack of experience. Males in breeding colors can be identified, however, and some large females, also. Some individuals were as follows:

♂	♀
20	21
23	17
24	21
25	19
26	18
22	18
24	
22	
20	
24	
19	
20	

See DATA for further measurements & breakdown

cgg 67-3

General -

Adults	-	37	
Juveniles	-	35	(11 - 15 mm, inclusive)
Young	-	3	(to and incl. 10 mm)
		75	

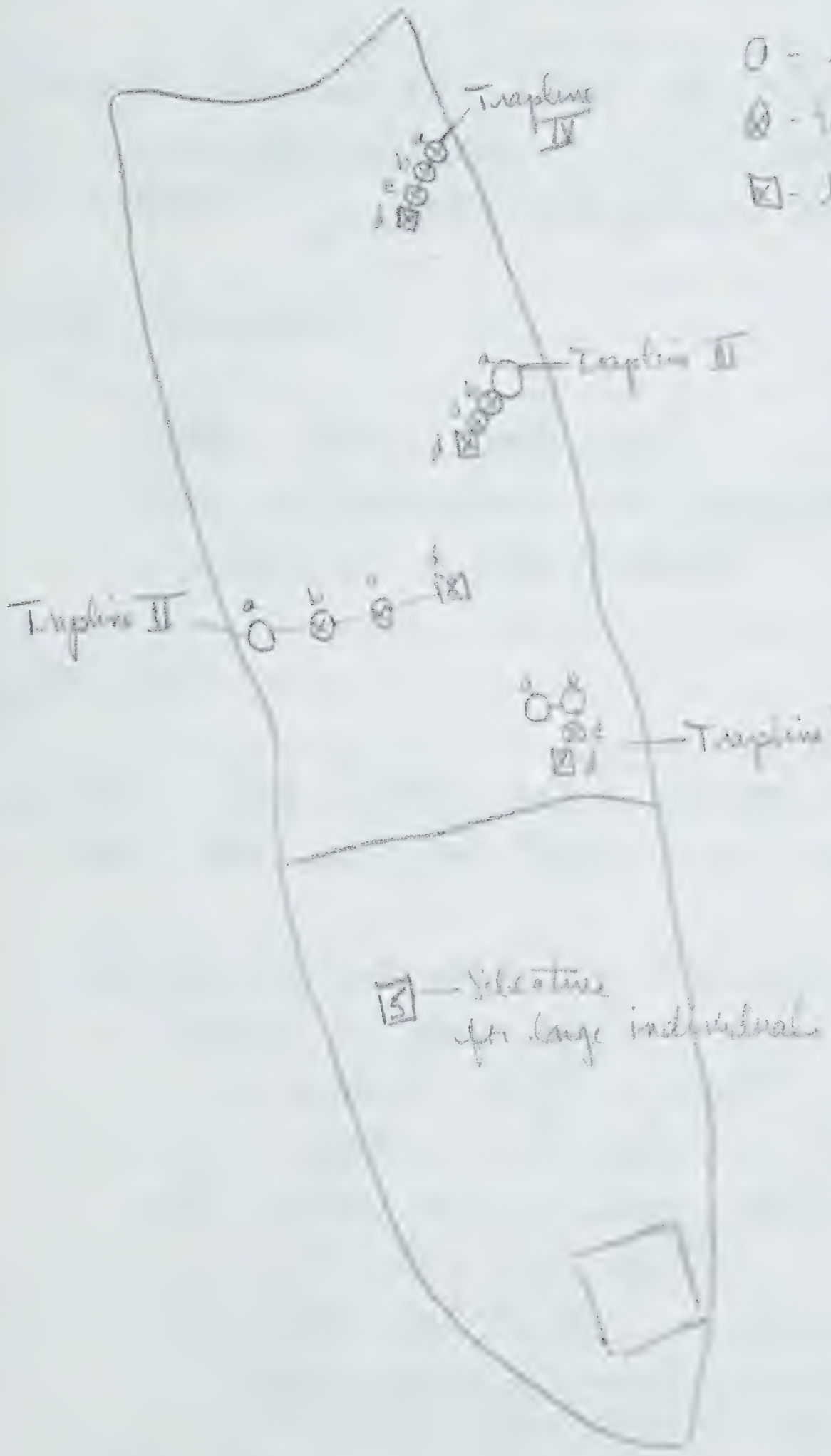
5 fish preserved in 10% formalin
→ later transferred to alcohol
Included in data.

C99 67.3

Devil's Hole - Measurements taken 21 June 1967

CGJ 67.3

Devil's Hole. Trap Placement
21 June 1967



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67-4

Devil's Hole, Ash Meadows, Nye County, Nevada.

Carol J. James

30 June and 1 July 1967

Attempted Removal and Count of Entire Population of Cyprinodon diabolis. C.L. Hubbs, R.R. Miller, J.E. Deacon & families, C.J. James, Don Johnson, Elena Arnold.

Initial Observations:

Weather - clear. Gentle wind.
Algae quite abundant on shelf and floating algae present at edge of upper shelf.

30 June 1967

Carol J. James

1:30 A.M. Dr. Deacon and I arrived at Devil's Hole and set fish traps (see map)

8 traps (1/16" wire mesh - no bait used)
(4) set on upper shelf
3 sinkers (~2.3/4'. in depth)
1 floater (water only ~1.5' deep)
(3) sinkers set on lower shelf at ~21', 24', & 27' depths.
(1) floater set on the side of Devil's Hole near a small out cropping (see map) near the corner of the upper shelf near trap [1].

Observations at that time (1:30 - 2:30 A.M.):
C. diabolis very numerous on shelf. Counted fish on the large rock at the NE corner of the upper shelf (near upper shelf trap [1]) ~(2' depth). In different areas on the rock, we counted 20, 11, & 16 fish within an 8" diameter. All of these fish

CJJ
67-4

were quite inactive except when disturbed. Beetles were very numerous at the water's edge and planaria were active. Scum present on the surface, shifting occasionally. Eighteen (18) fish caught by hand and placed in a sinker trap on the upper shelf.

9:00 A.M. – Returned to Devil's Hole with Drs. Carl Hubbs, Robert Miller, & James Deacon.

Pulled Traps and placed fish in temporary containers (styrofoam coolers – used whenever such containers are necessary).

Traps set (0130 - 0900hr.) total of 7½ hrs.

Total trap hours = 60.

Upper Shelf

Trap	Depth of trap (ft.)	No. of fish Captured
1	3½	0
2	2	0
3	2	7*
4	floater	4

* This was the trap we placed 18 captured individuals in initially (0230hr.

Lower Shelf

(See map for placement)

CJJ
67-H

(Lower Shelf)

Trap	Depth of Trap (ft.)	No. of fish Captured	Remarks
1	21	1	♂
2	24	0	
3	27	16	
4	floater	1	♂

Any individuals dying were preserved in 10% Formalin.

Seined with little success. We tried dip netting and captured 31 more individuals. Total of (60)

C. diabolis (captured through trapping and dip netting) were placed in two capture-traps (traps we had been using but with the end holes closed with plastic. Traps were approximately equal in contents, considering sex + size ratio. The sixty individuals were as follows:

	Number of Individuals
Males	21
Females	12
Juveniles	21
Young	5
New Born Young	1

Observations & determinations made by R.R. Miller

Juveniles = approx. 8-15 mm ; Young = approx. 6-8 mm
New Born Young = approx. 5 mm.

Note - one of the males possessed a deformed caudal peduncle.

Observations: Air Temp. at approx. 1130 hrs. 91.5°F.
Water Temp. constant 93°F.

CGG
67-4

Slight schooling of fish noted (as previously). No bee activity. Beetles dispersed. Scum present.
Left 1130 hrs

Water level - 1.91 at approx. 1100 hrs.

2110 - 2315 hrs.

Hubbs, Miller, Deacon, James, Don Johnson, Elena Arnold.

Returned and used dip nets again to capture as many individuals as possible. Dip netted an unknown number of fish - again a preponderance of young. These were put into two newly made capture-traps and left on the shelf.
Check other capture-traps and fish appeared healthy.
(These ② traps were placed in the lower shelf area whereas the new ones were placed on the upper shelf.)

1 July 1967

0225 - 0400 hrs. Dr. Deacon, Mrs. Miller, & I removed another 137 individuals with dip nets. Adults more numerous than previously. Many very small (5-8 mm) fish were seen and captured.
All 137 fish were placed in one of the two capture-cages used for those captured from 2110 - 2315 hrs (30 June).

0700 - 1000 hrs Hubbs, Miller, Deacon, James.

Count & Measure Fish. Dr. Hubbs noted 23 individuals on the upper shelf when we

first arrived. Dipnetting done while counting and sexing was accomplished yielded 37 more fish as follows:

	Number of Individual
Males	7
Females	6
Juveniles	23 (+ (1) Juvenile pickled)

(See) Slides – CJJ 67-5
PICTURES – #6 + #7

The fish were removed from the capture-traps. Those two containing the 60 individuals collected 0900 - 1130 hrs. 30 June contained only 29 fish when we opened them – one of these was a large dead female (possible cannibalism). The other 28 were all alive, large adults. No young remaining in the traps. Checked other capture traps. Almost all fish <8mm long were lost from the capture-traps.

CJJ 67-5 PICTURE #5

Count of Live Fish Captured 30 June + 1 July
(remaining in Capture-traps + incl. those dipnetted 0800 1 July)

	Number of Individuals
Males	51
Females	42
Juveniles	124
Total	217

This does not include pickled individuals (those who died during the procedures 30 June + 1 July.). Pickled individuals were also not included in photographs.

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67-4

This 217 individuals represents all live fish captured and counted. An additional 31 were preserved making a total of 248 we have recorded. (See following page.)

In addition to these, many fish were lost from or eaten while in the capture-traps. The outstanding majority of those captured were young. However, after one day in two capture-traps, an original population of 60 including both young and adults had dwindled to 29 (incl. 1 dead female) - adults only. This means that we can accurately add 31 individuals to our total count and suggests that young were eaten in the traps. In addition to this accurate addition, we estimated that between 2110 and 2315 hrs. on 30 June in excess of 200 fish were captured and placed in two new capture-traps. At 0225 to 0400 1 July an additional known 137 fish were added to one of those two capture-traps. At 0700 - 1000 that day counts from these two capture-traps resulted in 152 individuals. Therefore, more than 185 individuals were lost out of these traps. This 185 (minimum) can be added to the population estimate and since the preponderance of young originally put into these traps was not sustained, this further suggests predation of adults or young.

Total number of live individuals counted	248
Total number known lost (preserved)	31
Estimated number lost (minimum)	185
Minimum Estimated Population	464

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67-4

~~included in photographs.~~

Photographs were taken by Don Johnson after it was found that handling and individual measurement of the fish would be tedious and hard on the population. Photographs were taken of the fish placed in groups in ½-¾" of water in a styrofoam cooler lid with a cm ruler placed in the background. 250 speed. Light ~2. Measurements will be determined from the photographs. (See 67-5 page 9)

31 Individuals were preserved during the two days. Again, these were not incl. in photographs taken. They are as follows:

	Number of Individual
Males	4
Females	1
Juvenile	26

Total Fish Captured and Counted

	Number of Individuals
Males	55
Females	43
Juvenile	150
Total	248

cgg 67-4

Note: Sex ratio on final counts are probably biased due to the sex determination of intermediate-sized fish.

Remarks —

Coloration of males was noted to attempt acquiring some idea of size & initial sexual dimorphism.

Male - First distinguishing markings elongated anal, dark stripe on dorsal fin — 14 mm

Male - Small but fully colored — 18 mm

Male - " — 16 mm

Male - " — 14 mm

Male - Long anal. Slightly black on dorsal. Starting to color — 18 mm

(Female - 26 mm
Female - 18 mm)

Habitat significantly disturbed. Floating algae completely dispersed and algae stripped off most rocks on the upper ledge. Significant number of young and eggs possibly destroyed by activity.

SLIDES

Taken 1 July 1967 of C. diabolis.
See CJJ 67-5 page 2.

Picture	Subject
#1, 2, 3, 4	C. diabolis captured 2110-2315 30 June and 0225-0400 hrs. 1 July. Many lost while in capture-traps. (esp. young)
#5	- Twenty-eight live adults remaining in two capture-traps originally containing 60 individuals (adults + young). Individuals placed in traps 1130 hrs. 30 June.
#6, 7	C. diabolis dip-netted from 0700-1000 hrs. 1 July.

CJJ67-4

Preserved + 1
slides

Total length (mm)	# Parasites	Total Number of Individuals
4.5	0	1
5.0	1	3
5.5	0	3
6.0	0	0
6.5	1	3
7.0	2	6
7.5	3	13
8.0	3	17
8.5	3	10
9.0	1	8
9.5	2	9
10.0	1	12
10.5	2	7
11.0	0	7
11.5	2	7
12.0	0	3
12.5	1	4
13.0	0	6
13.5	0	3
14.0	0	5
14.5	0	2
15.0	1	7
15.5	0	4
16.0	2	9
16.5	0	10
17.0	0	7
17.5	0	4
18.0	1	10
18.5	0	8
19.0	0	8
19.5	1	8

CJJ67-4 (cont'd)

Total length (mm)	# Females	Total Number of Individuals
20.0	2	9
20.5	0	3
21.0	0	3
21.5	0	3
22.0	0	5
22.5	0	8
23.0	0	3
23.5	0	4
24.0	0	0
24.5	0	1
25.0	0	2
25.5	0	0
26.0	0	0
26.5	0	1
27.0	0	1
28.0	0	0
	30*	

[247]

* one berry female lost

Measurements Taken of Devil's Hole

30 June 1967

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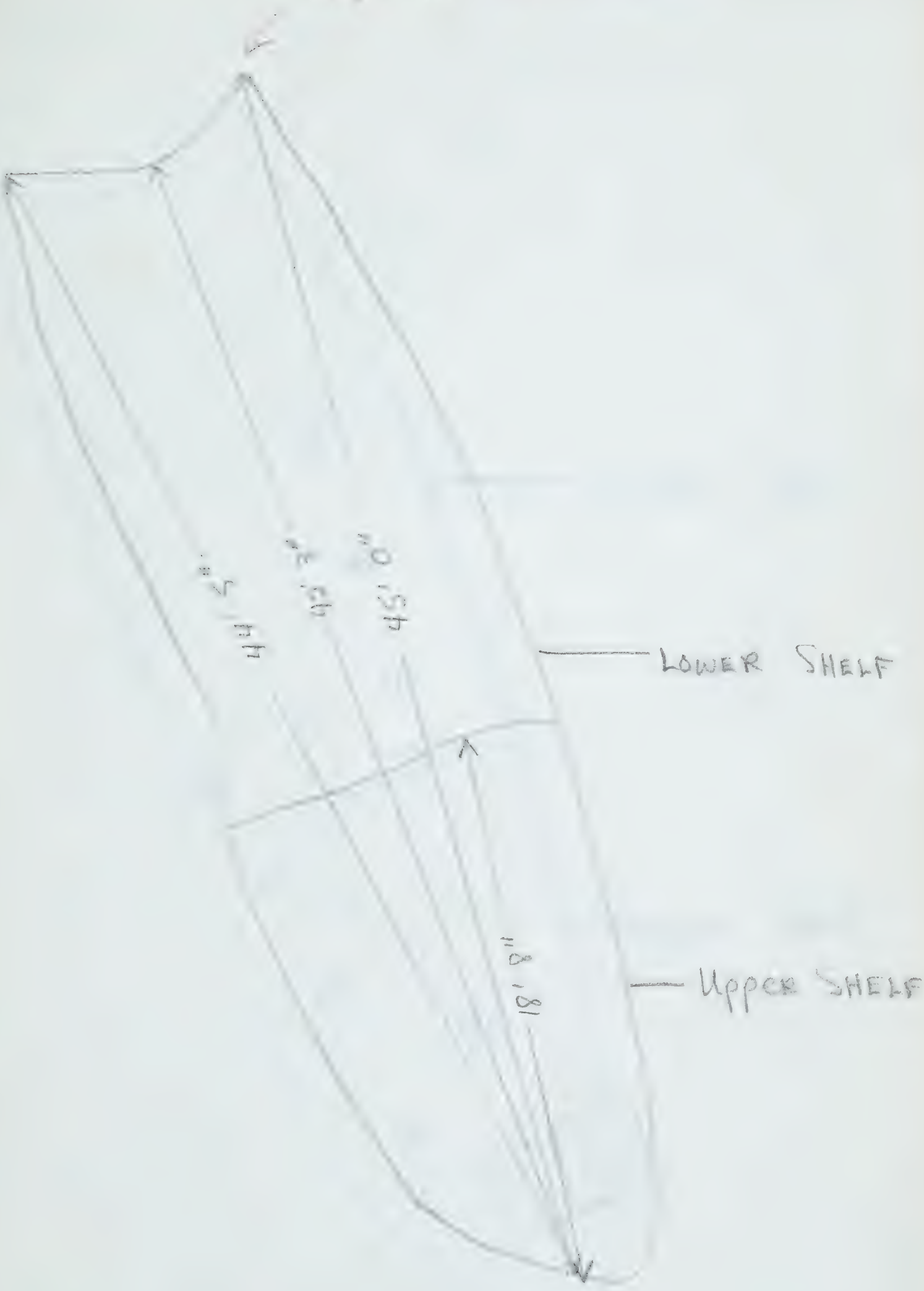
67-4

• Depth measurements
(Maximum and minimum depths of the upper shelf)

099
67 H

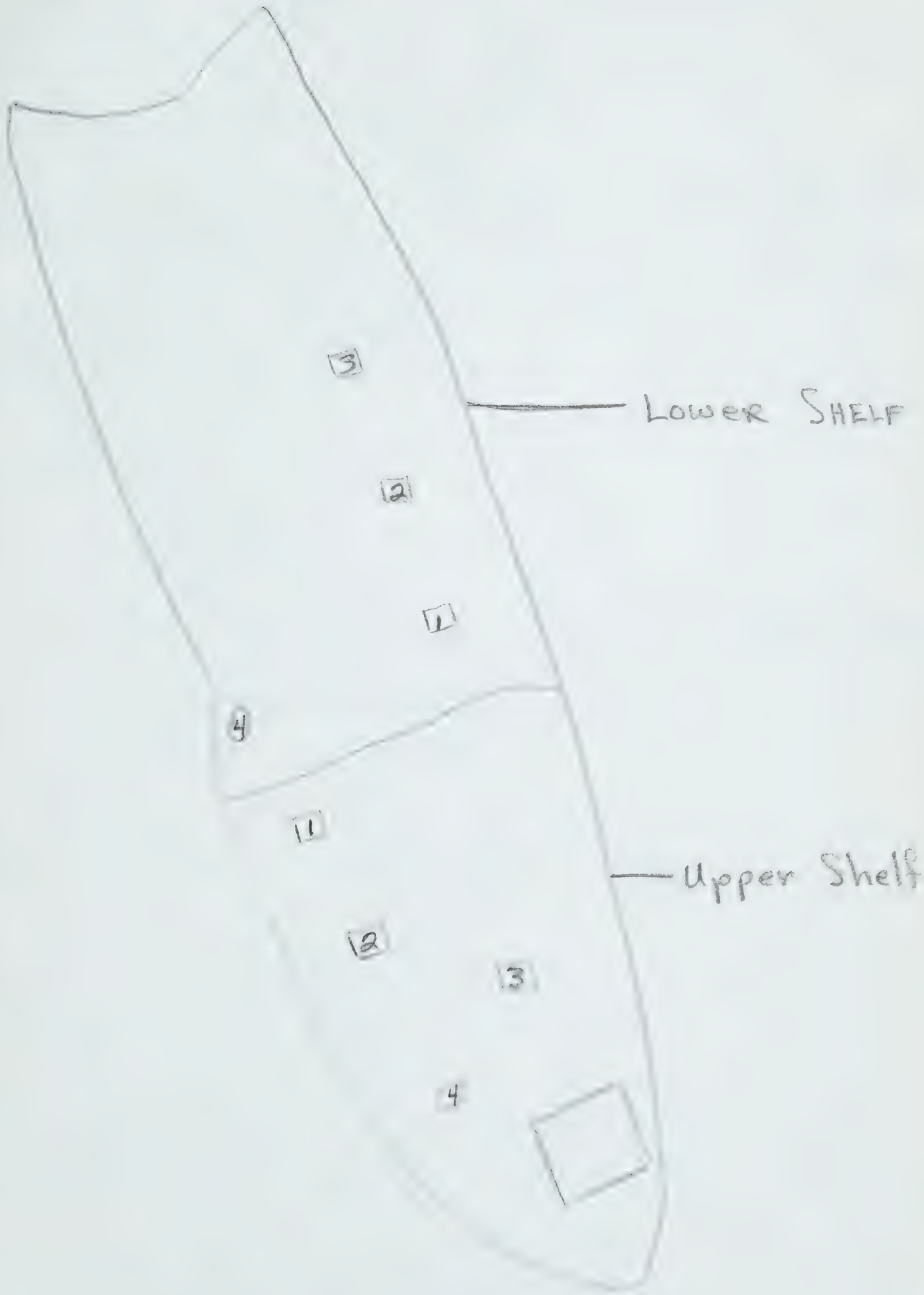
Varel
Edge of Rock



MEASUREMENTS TAKEN OF DEVIL'S HOLE
30 JUNE 1967

CGG 67-4

Placement of Traps at Devil's Hole, 30 June 1967.



☒ - Sinker

⊗ - Floater

Robert R. Miller - Notes on D. Hole

Sept 27, 1942 9:10 A.M.

Water temp. = 93°F
Air = 27.5°C
Fish abundant on shelf - 200 est.

January 1, 1966
11:15 A.M.
Water Level - 1.86
Water temp. - 33°C
Air - 49°C
Fish estimate = 180-200 individ.
(Bob Lee took 31 of them)
Leeches reported.

Cyp. 1950 - all fish taken out

C. n. pectoralis - Lovell's Spring only -
now named Schoolhouse Spring.
temp. - 94°F 1 July 1967
Only spring w/ same temperature (water)
as Devil's Hole. But no connection.

CGS 67-5

Carol J. James

Devil's Hole, Ash Meadows, Nye Co., Nevada.

7 July 1967 0500 - 1200 hrs. DST

C. James, S. James, Jim Teneu

Initial Observations:

Weather - partly cloudy at 0400 hrs. (some rain in Las Vegas Valley). Completely cloudless at Devil's Hole by 0800 hrs. Wind - slight and variable breeze.

General condition - Scum covers surface of pool - fairly heavily. No floating algae. Algae on shelf sparse - filled in little.

Activity - 0530 hrs. Many large fish on shelf. Activity high. Estimate 150-200 adults & large juveniles on upper shelf. Few small individuals seen.
No territories.
Bees active - 0530 hr. Planaria also.

Collection:

Trapping. Traps lined with 1/32" wire mesh
No bait used.
Set according to map.
Total - 17 traps

0630 - 0830 hrs. (17 traps) + 0930 - 1130 hrs. (12 traps) Total trap. hrs = 58

cgg 67-5

0630 - 0830 hrs.

Upper Shelf - 5 sinkers were placed as per map.

Trap	Depth (ft.)	Number Captured
1	3½	0
2	2	1
3	2½	0
4	2	0
5	2	0
		1.

Lower Shelf - Three Traplines, each with four traps - one floater at top and three other weighted traps on a line and at depths as indicated.
See map. "a" is floater & "d" is lowest trap.

Traplines I, II, & III

Trap	Depth (ft.)	Number Captured	Remarks
I a	floater	0	
b	10	3	
c	20	3	
d	21	3	1 ♂; young ♂ (14mm); + large ♀
II a	floater	0	*see "note"
b	10	0	
c	20	4	
d	28	2	

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Trap	Depth (ft.)	Number Captured	Remarks
IIa	19-20 see note	1	♂
b	25	0	
c	35	0	
d	45	0	

Note – Since all but the floater were weighted and lines tied to the west bank, the traplines were not vertical, but traps rested on the western slope to the lower shelf.

IIa – the 19-20' depth indicates generally that the rest of the line was nearly vertical, but that this trap rested on the edge of the small cliff or drop-off which is at approx. 20' before its sudden plunge to 45'.

Da – Although no capture was made at this trap, a juvenile (approx. 12mm) was seen at the surface near this trap.

Also, snail casings and dead dytiscids were present in the traps – presumably remains from trapping done at Saratoga Springs over a week earlier.

Scum dispersed because of setting traps + seining. Water very clear – viewing device needed for by-passing scum.

Time required to set traps because of tangling of lines + placing. Inner tubes used to place traps.

So. part of shelf – young seen in shallowest water.
Fish activity decreased as traps set.
Water level varies.

0930 - 1130 hrs.

No traps on upper shelf – seining & dip netting done during some of this time.

Trap	Depth (ft.)	Number Captured	Remarks
Ia	floats	0	
b	10	1	
c	20	0	
d	21	1	
IIa	floats	0	
b	10	2	(trap faulty) one larger, one 11 mm
c	20	0	
d	28	10	(trap faulty) 3 adults lost d. majority are ♂s.
IIIa	19-20	0	
b	25	0	
c	35	0	
d	45	0	

Seining & Dip-netting:

1015 - 1115 hrs. Fish extremely scarce; during this time, fish were seen around the lower traps on lower shelf. 10-20 fish seen around trap 3d at 21'.

Light green traps provide background so that the fish can be seen fairly easily.

Readings with a telethermometer & O_2 & temp. - taken at several places at several different times.

I will ~~attempt~~ to identify the place at which the readings were taken by referring to the trapline & trap, where applicable.

	Trapline / Trap	Other Position	Light Probes Black	Red	Temp.	O_2
0700 hrs.	Shelf	NE sloping rock	34	8		
	I b		10	10		
	II	10' depth but in deeper water - away from shelf.	94	38		
	II b		92	32		
0830 hrs.	Shelf		155	99	33.5°C	3.0
	I a	Surface	155	90	"	"
	I b		109	25	"	"
	I d				"	"
	II a				"	"
	III	Surface	133	70		
	III	10' depth	101	46		
	III	40'			33.7°C	3.0
	III d	(45')			"	2.6

Air Temp. = 27.6°C

O_2 sat. = 4.1

CGJ67-5

Trapline	Other Position	Light Probes Black	Red	Temp.	O_2
1130 hrs. –					
Shelf	surface	197	107	33.4°C	2.2
Shelf	trap [2]	166	82		
Ia				33.5°C	2.1
Ib		147	72		
Id				33.5°C	2.1
IId				33.5°C	1.9
III	10' depth	128	68		
III a	(20')			33.5°C	1.9
III d				33.5°C	2.0

Air Temp. = 29.4 °C

? O_2 sat = 2.6

1200 hrs. – CO_2 – 4.0

pH – 8.2

Total Alkalinity – 150

2 fish preserved in 10% formalin and later transferred to alcohol – included in data.

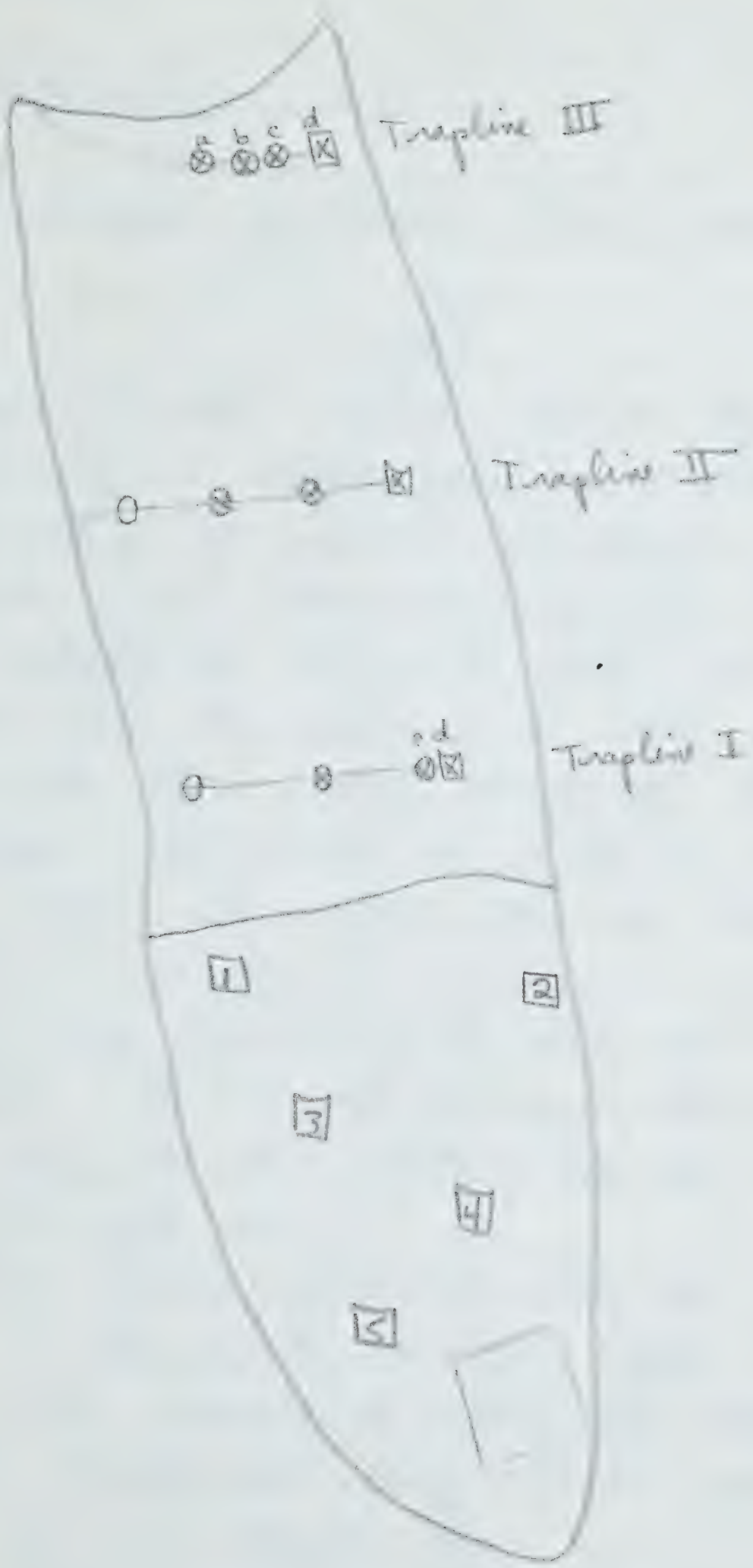
Included in data { 1 fish – branchiostegal w/ constricted caudal region.

2 fish – S-shaped spine from dorsal view.

CJJ67-5

Total length (mm)	Total	Juv. + Unsex	♂	♀
7	1	1		
8	1	1		
9	2	2		
10	4	4		
11	6	6		
12	2	2		
13	1	1		
14	1	1		
15	2		1	
16	2		1	1
17	1		1	
18	4		1	3
19	3		2	1
20	3			3
21	4		2	2
22	2		1	1
23	2		1	1
24	4		4	
25	1		1	
26	1			1
27	0			
28	2			2
Total	49	19	15	15

99/67-5 Devil's Hole, Trap Placement
7 July 1967



[1] Sinker
O floater
⊗ weighted hap

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Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

18 July 1967

J.E. Deacon, Jim Tener, Steve James

DT

Arrived at about 0600 hrs. and set three vertical lines (of 5, 4, & 3 traps) spaced at 10' intervals in the deep end [CJJ comment - see map for placement of traplines. All traps except top traps at each line are weighted and rest on the shelf.] and 5 [weighted] traps near the bottom on the shelf. Light readings were taken and a water sample for chemical analysis. Water level at 0630 hrs. was 1.86 on the scale. The oxygen probe was placed in the water at 0645 hrs.

Many fish could be seen on the shelf - probably ca 200 with all sizes represented except the very tiny ones which I did not look for. Juveniles were seen.

Steve James picked two bats out of the water and I saw several bees get trapped in the water. This may represent a significant energy source to the environment along with the several insects that also get trapped here.

Steve James and Jim Tener stayed to measure trapped fish and seine and dip-net additional specimens. We captured 22 fish in the bottom trap in the middle line (ca 30' in depth) [~27'] and one fish in the bottom trap of the vertical line nearest the shelf in ca 26' of water. Jim and Steve measured a total of 35 fish and

GED

2
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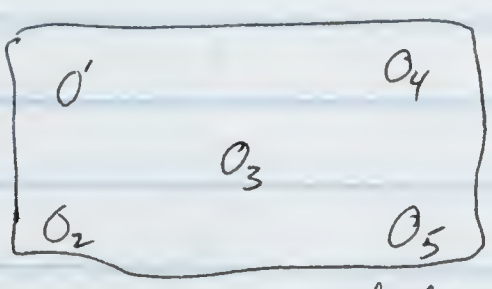
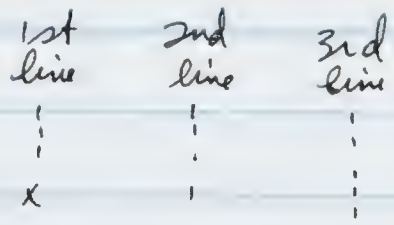
were impressed by the fact that there were very few to almost no very small fish as there have been in the past. They seined with the 4' x ⅛" mesh seine and dipped with the 4" aquarium dip net. They also collected some planarians which we carried around in 15 gals. of water all day - they died probably after the water temp. reached 37°C. After all planarians were dead Jim Tener noticed a yolk sac fry C. diabolis still alive in the water. We had not previously known that it had been collected - probably when the water was dipped out of Devil's Hole. It does show that reproduction has occurred since we removed most of the fish on 1 July.

At 0630 we took light readings
Above the water surface - 135
½" below surface 125





	unshielded probe	shielded probe
#3	115	
#4	110	62
#5	78	

1st line at 10' -	45	22
2nd line at Top -	125	80
10' -	100	55
3rd line at Top	78 ← ? →	78
10'	70 ← ? →	69

(readings taken in note + transferred later)

GED

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All traps were in the water by 0630 but light readings and observations kept us in the water until 0700 hrs.

Water level at 0630 - 1.86
0915 - 1.7

Water temps.

over shelf - 33.9°
1st line
surface - 33.5°
10' - 33.4°
20' - 33.5°
2nd line
30' - 33.5°

Total Lengths - of all fish captured)
(measured by Jim + Steve - sexes not determined)

mm	#
8	1
9	
10	2
11	3
12	4
13	2
14	2
15	3
16	4
17	
18	1
19	3
20	2
21	4
22	2
25	2

Total 35

JED

4
Copy

Water Chem (analysis in Field using Hach DREL - Deacon)

pH - 7.8
Total alkalinity - 155 ppm
Phenolthalein alk - 0
CO_2 - 4 ppm (taken after considerable agitation)
Total Hardness - 195 ppm
Ca Hardness - 120 ppm
Sulfates - 20 ppm

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

15 August 1967 1920 – 2030 hrs. DST

Vera & Carol James

No trapping or seining done because of storm activity.

1920 hrs. – Water level 1.94

Gusty winds 45 mph and stormy. Complete cloud cover but still some light (no flashlight needed to see & estimate fish on upper shelf).
Algae abundant except for area of feeding (mentioned later) and still not heavy in deepest portions of northern half of upper shelf.
Floating algae – very well developed, although none at extreme southern edge of shelf in shallowest (2") water. Now two mats at Southwest edge – one directly north of one noted CJJ 67-6. Many floating "pads." Very few or no bubbles on surface (as noted at this time of day CJJ 67-6). Also, none on algae that I could see. [Note: absence or reduction of bubbles from surface & algae, in comparison to previous observations, due possibly to cloud overcast during time of day sun would normally shine directly on shelf?)
Scum much reduced. Shifting with wind. Scum only covers approx. 1/4 of the water's surface, & most of this is over the upper shelf area. Rest of scum majorally over western edge.

cff 67-7

1935 hrs.- Est. 300 - 350 fish on shelf. Males predominate. (I tried collecting a female and couldn't find one. Of course, conditions were not ideal, though.) Most of fish were on bottom. Although small schools on top: Approx. 8 in a school - perhaps a total of 50 fish on top. Feeding in algae - slight schooling noted.

→ Western border of slope - As Area I algae "eroded" away - very sparse. Grey matter showing - so much so that no channels could be seen. Again eating grey matter.

Many adults. A few young & small juvenile, but majority of fish adults & large juvenile.

Beetles at edge and planaria somewhat active. Some play activity of fish.

1940 hrs.- Light rain.

1945 hrs. (Between 1935 & 1950 hrs, cloud cover darkened - flashlight now necessary to see fish. Slight Rain (but only very light and intermittent). Rain makes water appear murky.)

Air Temp: 87.5°F
Water Temp: 33.8°C
Light -
Black } off scale (below)
Red }

With Darkness, decrease in fish population

2000 hrs. - Est. $100^{(+)3}$ fish on shelf. Also, higher proportion of smaller fish. Many adults appear to have

left shelf. Majority now are juveniles w/ some adults & some young. Concentration of fish on upper shelf seems to be highest at the NE-sloping rock. (Note - more light reflected off this rock. Less algae here. Rock appears much lighter than rest of shelf.)
Rain up to this time has been only very light sprinkles for no more than one or two minutes.
Again - quite dark now. Fish "spooky."
More young seen than at any time since 30 June & 1 July 1967 (see CGJ 67-4).
→ Collected 6 fish — by dipnetting.
Again, females absent or rare.

Approx - 2010 hrs. Heavy shower activity - but intermittent only - approx. 1 minute at time. Much lightning.

2020 hrs. - Still intermittent l. showers (stop + start suddenly). While collecting planaria, at rocks at south end of shelf, Approximately ~10 fish approached. Several fish even came up onto the shallow water ledge of one of the rocks where we were shining the light. Some of these collected - included in 6 fish mentioned above. Of the ten fish which approached, 2-3 Adults, 2-3 young, & rest Juvenile. Planaria on rocks, but not swimming at surface of water.

2030 hrs. - Showers stop almost completely. Wind a little stronger & gusty. → 15-20 mph. down in Devil's Hole, up to 45 mph. above at ground level.

One last look at shelf (quite complete look) showed almost no fish visible.

cgg 67-7

Very few fish visible on upper shelf.
Count - 2 Adults, 5 young, 3 Juven
over approx. 2/3 of shelf.
Note - these figures, I feel, are not totally accurate; the darkness, wind blowing the water slightly, & very scattered & sparse scum undoubtedly caused me to miss some fish. However, the investigation was as thorough as possible at that time and, from observations made directly around me which showed no fish present in many areas, I feel these figures are significant and indicative.

Activity now greatly resembles the activity noted at 2300-2400 hrs. 2 Aug. 1967 on the 24-hr. observation survey. Light conditions similar. Perhaps even less activity now than then.
2030 hrs. - Water level = 1.91

Six fish preserved in 10% formaldehyde w/ Copper Sulfate. Later transferred to alcohol.

CSS 67-8

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

21 August 1967 1740 - 2000 hrs.

Steve and Carol James

Initial Observations:

Weather - partly cloudy Wind - none

Algae - good cover on shelf. Still somewhat sparse in deep portion at NW portion of upper shelf. Bubbles on algae & few on surface.
Scum - covers only about 1/3 of upper shelf - not over lower shelf at all. However, scum that is present is very "heavy" - falling into water when touched.
Water very clear.
Beetles & planaria on rocks.

C. diabolis - ~ 20 fish on surface. Est. 350+ on shelf. Some chasing observed. Many juveniles.

Water level - (800 hrs) 2.04 on scale.

Collection:

Collection of fish was made only by seining. We used a 6' x 6' (1/8" mesh) umbrella seine. We put it in at about 1810 hrs. and

left it for about ½ hr. Fish collected on it quite readily. It occupied almost the entire width of the shelf and was placed about 2-3' from the shelf ledge. Rocks and the metal frame, however, prevented it from resting completely on the ground, so fish frequently went under it, also. After ca ½ hr. we lifted the seine and found that this procedure is quite successful - few fish swam off the seine. Over 150 fish were captured at this time. These were placed in styrofoam coolers and the seine was put back on the shelf while other equipment was being set up.

We used a small show aquarium and attachments in the aquarium to hold fish and provide a background (with mm ruler) for slides that were taken. In this way, the fish can be measured and (hopefully) sexed without unnecessary handling - esp. of large numbers of individuals. In this first attempt at this method, we did not have supplementary light and so I had to open the camera (Exa) as much as possible and hope for the best. I was using a wide angle lens w/out Polaroid lens. Setting: - 3.5 + 25. ASA 64 Ectachrome used. Light reading originally ~ 4.5. Rope was used to keep the fish away from the corners ▽ bottom of the aquarium - styrofoam will be used in the future. I found that the fish did not remain sideways, becoming vertical, facing the camera, and bending in such a way as to make measurement of some from the slides apparently impossible. Using hand pressure to further limit their movement by changing the distance between the white background and the front glass from ~ 1½" to ½-¾"

was successful in some instances, but caused panic among some fish. Investigate use of MS222.

No light readings taken (telethermometer malfunctioning.) At 1935 hrs. - O_2 = 0.5 (shelf) & temp of water at surface (shelf) = 33.8°C.

Fish were taken again when the umbrella net was raised the second time (this time - ~ <75). These were added to the others in styrofoam coolers and five pictures were taken - dividing the fish arbitrarily into 5 groups to facilitate measuring from slides.

Six of these fish - 4 (large) ♀ & 2 ♂ were preserved in 10% formaldehyde (w/Copper Sulfate) Again, these are included in the slides. All others released.

Seeming increase in # of ♀ (or at least proportion of ♀ to ♂) ~~was~~ Not substantiated, however, because of hurry due to impending darkness.

Slides did not develop well - no measurements possible.

CJJ
67-9

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

29 August 1967 approx 1800 - 2000 hrs. DST
(no clock)

C. James & CW Ivey

Initial observations:

Weather - some clouds but clear over "hole" area. No wind.

General Condition - Algae in very good condition - more abundant than I've ever seen it. Algae very abundant on NE sloping rock - in scattered, heavy clusters ("bubbles" of algae), especially on the N. + NW portion of that rock. In this area, the algae resembles a bubbling volcano (this area is quite shallow). Floating algae abundant on West edge of upper shelf.
The SE portion of the shelf appears very grey - see previous notes on grey matter.
Scum very broken - v. little left.
Most of surface area of water clear. Some 1-2" patches of scum over upper shelf.

Activity - When we arrived, the hole was completely in shadows (rocks as well as water). Only ~ 50 fish on surface
~ 200-250 on shelf. - all sizes but many small.
(juveniles + sm. adults)

They were feeding — most of them observed feed (as before recorded) on the grey

CJJ 67-9

matter exposed over much of the NE portion of the shelf. Some chasing observed but no territoriality or spawning. Fish activity on shelf considerably less than on other previous visits at this time (sun setting earlier now - the reason?) Water level at ~1800 hrs = 2.0

Collection:

6x6' Umbrella seine and some dipnetting used. Picture set-up used to measure most of fish (see CJJ 67-8).
Hand measuring of 49 individuals.
Collection of 4♀ x 2♂ + malformities + others dying unintentionally.

Seine placed as soon as possible (~1810) so that it extended about 2/3 onto the sloping rock and down into the deep NW shelf area. Left for approx ½ - ¾ of an hour. Good "catch" considering somewhat sparse shelf population. We placed the captured fish in styrofoam coolers and replaced the umbrella seine onto the shelf. Second "catch" taken about ¾ hr. later - about ⅓ of the original catch. Total individuals - ~200-250. Included in this number are ~10 young and some juveniles that I dipnetted from the more shallow Southern portion of the shelf during this time. The umbrella seine has not been very effective in capturing fish of this size, whether because of the seine itself or because of its placement in deeper waters (remember, however, it is also placed on the shallow NE sloping rock).

CJJ 67-9

Pictures taken (see CJJ 67-8) were of four different groups (some groups taken twice). Setting at 3.5 ~ 25 on the Exa camera w/ wide angle lens but no polaroid filter. No strobe necessary (much reflection of light in hole area - off rock sides). Light reading = 8.5 (on light meter)

~1900 hrs - Different O_2 machine used than previously

Water temp. - 34.2°C

Air temp. - 35°C

O_2 machine used for all readings

Light

~~Red - below scale~~

Black - 26.3 °C } probe placed in middle of shelf facing (top toward) south.

O_2 - 4.6

~2000 hrs. - O_2 sat. = 8.4 at 33.8°C & 7.8 at 33.6°C

O_2 shelf = 3.8 at 34°C & 7.6 at 33.6°C

I believe these O_2 measurements to be inaccurate - machine would not go back to <.1 when probe placed in grey bottle after readings taken. Probe was left in water for ~45 min. before first reading was taken.

O_2 - taken by analyzation of water w/ little chemistry kit.

O_2 = 3 - 4 ppm (closer to 3 ppm)

Observations

Males are not as dark in color as on all previous visits. In fact, many large males

are only a light grey - some smaller ones (~17-18 mm) have only black on fins, where previously they would have been very dark by that size. Finishing breeding season? This decrease in color intensity results in some difficulty in differentiating sexes and could explain why in CJJ 67-8 I noted a seeming increase in proportion of females to males. At that time, increasing darkness w/ no strobe caused me to hurry as much as possible in taking pictures so I did not examine the fish at all at that time.

Charlie and I found two fish which showed evidence of planaria apparently being either scavengers or predators on C. diabolis. The first is a fish ___ mm in length which had been hopelessly caught in ~~the~~ algae and had 5-7 planaria around (crawling on) it. With these was another, smaller invertebrate - identified as a ___. The C. diabolis was still living.

Another, larger fish was found several minutes later. It was dead and also had several (5-7 again) planaria crawling on + attached to it.

Both of these fish were preserved - see later observation on specimens.

(The entrapment in algae of one and death of another were discovered after activity on the shelf - which may have led to or caused either.)

Handling of these two fish resulted in a sticky deposit on our hands. Note the white substance noted on the live beetle encircled by planaria observed in CJJ 67-6.

✓ Fish in alcohol are either in the slide or were measured by hand

CJJ 67-9

except for these last mention fish (2) w/ planaria.
Malformities.

See Slides.

1967-9

Slide I

mm	Jan.	♂	♀	♂
13	III			
14	IIII			
15	I	I		
16		I		
17		I		III
18		II		II
19			I	II
20			I	II
21				
22		I	I	I
23				I
24				IV
25				
26				I
27				
28				
Totals	9	6	4	15

Slide II

11	I			
12	I			
13	I			
14				
15				
16		I	II	II
17				I
18			III	II
19		I		
20		II		I
21		I		
22		I	I	II
23			I	I
24		I	I	I
25		I		
26		I		
Totals	3	9	7	10

CJJ67-9

Slide III

mm	♀	♂	♀	♀
11	I			
12	II			
13	I			
14	I			
15	I			
16				
17				
18		III	III	
19		II	I	
20		I	I	
21		II		
22			II	
23		I	II	
24		III		
25		I	I	
26		I		
27			I	
Totals	6	15	11	

Slide IV

9	I			
10	II			
11				
12	I			
13	I			
14	II			
15	I			
16			I	
17			I	
18			II	
19		II	I	
20		II		
21			I	
22		II	III	
23		I		
24		I		
Totals	8	8	9	

CJJ 67-9

Measurements Made By Hand

29 August 1967

Length (mm)	TOTAL	No. of Individuals: Juveniles & Young	Males	Females
8	1	1		
9				
10	2	II		
11	4	IIII		
12	3	III		
13	1	1		
14	1	1		
15	4	1	1	II
16	2		1	1
17	1		1	
18	8		IIII	IIII
19	3		1	II
20	6		II	IIII
21	3		III	
22	3		III	
23	3		II	1
24	1			1
25	3		II	1
	(49)	13	20	16

Notes – 19 mm ♀ - sl. humpback
23 mm ♂ - sl. humpback
one fish Bronze-colored

Some difficulty in differentiating sexes because of less distinct male breeding colors.

CJJ67-9

Total by Hand
Measurements
+ Sketch

Total Length (mm)	Total #	Juv. + Young	♂	♀	?
8	1	1			
9	1	1			
10	4	4			
11	6	6			
12	7	7			
13	8	8			
14	8	8			
15	8	4	2	2	
16	9		3	4	2
17	8		2	1	5
18	25		9	12	4
19	14		7	5	2
20	16		7	6	3
21	7		6	1	
22	16		6	7	3
23	10		4	4	2
24	10		5	2	3
25	6		4	2	
26	3		2		1
27	1			1	
28	1			1	
Totals	169	39	57	48	25

CJJ 67-10

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

10 September 1967 1710 - 2010 hrs. PST

C. James & C. W. Ivy

Initial Observations:

Weather - Sky completely overcast & dark clouds. Storms in nearby mountains (dry lake bed nearby flooding from runoff, only). Very slight drizzle, intermittent. Little or no wind.

General Condition - Scum abundant - over entire shelf and shifting.

NOTE: In order to see & count the fish, I threw (splashed) water over the surface of the shelf - done w/as little disturbance as possible & causing the water to fall much as rain would. This quickly dispersed the scum - causing most of it to fall into the water & rest eventually on the shelf. This could explain both the variation in amount of scum seen on various trips & recorded by others (JED), which could be due to rain activity which has been very frequent this summer, (esp. during the evenings) and for the murky appearance of the water during rain.

Algae - over entire shelf and very heavy ("piles" on sloping rock at NE portion of shelf) except for grey areas which are frequented by fish.

Activity - Approx. 200-250 fish on the shelf when we arrived. Some feeding. Juveniles & several very young seen.

Collection: 6' umbrella seine put in only a few minutes after we arrived. Putting the seine into position in the northern portion of the upper shelf frightened many of the fish over the ledge. The seine was left in for approx. 25 min. and then pulled up. Fish captured were put in styrofoam coolers temporarily and the seine reset. Approx. 45 min. later it was pulled for a second time and fish in coolers.

Pictures were taken of the fish - again using a show aquarium w/mm rule in background and Exa camera. 100 x 11 Kodachrome film - ASA 25. Light meter = 7.4

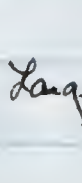
Strobe used - ½ power - from several different angles. Six picture taken - three pictures of each of two groups of fish.

Strobe always held 5' from aquarium.

Groups I
- Picture 1 - strobe at 45° angle to camera's right
- Picture 2 - strobe at 60° angle to camera's right
- Picture 3 - strobe in front of aquarium + above - Keup in picture

Groups II (lens cover at left in pictures)
- Picture 1 - strobe at 45° angle to camera's right
- 2 - Keup strobe in front of aquarium + above
- 3 - Keup strobe at 60° angle to camera's right

Large fish in position



An attempt was made to get 5♂ + 5♀ (all 16 mm) to go into a cage that we had constructed. Attempt unsuccessful because of small number of fish that were captured. In the first seining, we picked out

CJJ 67-10

the following individuals –

♂	♀
18 mm	17 mm
18	16
18	15
18	15
18	18
16	

Again - smallest fish not efficiently caught by umbrella seine. Also, fish easily go under the metal frame and placement to prevent most of this is difficult on the uneven shelf.

Observations:

We found one fish (adult) dead, with its underbelly slit open. One planaria was found in this area. Both specimens were preserved. Fish (no fin slide)

Males still appear lighter than during the first summer months.

Many small young.

Two bats were found dead in the water. These were disintegrating and covered with beetles. We also observed one live bat in the water. It evidently hit one of the rock sides at the other end of the "Hole," because we suddenly heard a flapping in the water at the deep end. It moved by using this motion and went from near the large rock at the north end of Devil's Hole to the planted outcropping at the western side. It climbed up on the

rock cliff and stayed there for several minutes. We soon heard the flapping again, and saw it in the water and crossing over to the eastern side of the upper shelf. We captured it when it again climbed up on a rock cliff and could only identify it as a Mystis sp. We, then put it on a rock at the So. end of the Hole and left it to dry. Only a few minutes later, it tried to fly, was still too wet to do so successfully, and so ended up back in the water, again. This is evidently the way that these bats end up drowning in the water - continuously trying to fly too soon and ending up back in the water.

Bees also in water.

Algae was dispersed considerably because of setting and placement of the cage.

Planaria were again observed on a beetle.

Planarians were not very active until dark.

I Collected an unidentified larvae (?) and some beetles.

Some fish were preserved in formalin.

Light needed to complete observations. Very dark (Black) at 8:15 P.M. when we left.

Noted - one fish (5-7mm) was attracted by the flashlight as I collected the beetle. I used my finger to brush it away, actually touching it several times, but it would not leave, staying at the surface at the rocks used to stand on (So. end).

Water temp - 33.5°C

Water level (2000 hrs.) - 1.94 on scale.

* Cage — a cage was constructed and placed in Devil's Hole at this time. Composed of a frame-cage of (united) ½" wire mesh hardware cloth

tied together with wire. Dimensions of this framecage is 2'x 4'x 2' ≈(depth). An inner cage of screening material (sections of which were sewn together with nylon line to make a bag the same dimensions as the frame cage) was attached to the inside of the frame cage. Entire cage is open at the top.

The cage was placed on the eastern side of the upper shelf (between the metal water measuring device and the sloping rock at the NE corner of the shelf. Rocks, algae, and a few (10) beetle were transfered to the cage. The cage was placed and supported so that its edges were several inches out of the water.

CJJ 67-11

Carol J James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

17 September 1967 1345 – 1830 hrs. DST

Carol James + C.W. Ivy

Stopped at Manse Ranch Spring and put in traps before coming to Devil's Hole. See CWIvy MST #2

Initial observations:

Weather - Partly cloudy. Wind to 20 mph above. (gusts to 40 mph in hole)
General Condition - Algae not as abundant as noted in CJJ 67-10. (fewer "mountains" of algae on NE sloping rock of upper shelf.
Scum abundant and heavy looking. over upper shelf + extreme N of hole
Activity - 120-150 fish on shelf. activity moderate. Some chasing but only casual. Several fish quite inactive. Majority are adults, although there are many juveniles and young also.

1400 hrs - Can see down to 50'.
Water level 1.82
Shadows over extreme 1½-2' of eastern? side of shelf.

As I dispersed the scum to view and

take pictures - fish seemed to become more active (apparently eating the scum that fell into the water).

One fish seen to remain unmoving for several minutes - exposed in the sun and over the grey matter until disturbed by another fish. (~1430 hrs.)

Fish collected by dip netting & seining and put into ~~tank~~ cage.

♂	♀
18 mm	18 mm
18	18
19	19
19	
19	

Photographs taken of these fish and others before selection. Many of the fish died while in styrofoam cooler even though the water was quite warm (at least 90°F.), the cooler was standing on the upper shelf (in the water), and we renewed the water frequently and handled them with as much care as possible. It was, however, necessary to use a measuring board to measure fish the approx size of which seemed right to put in the cage. Even careful handling with measuring boards is a terrible shock to the fish, and has been previously, also.

Note: while seining we found a new collection
[illegible] (~ 4" long) on the upper stock

CJJ 67-11

1425 hrs. - Air Temp = 36.3°C
Water temp = 34.1°C

Light - sunny but sun temporarily behind clouds.

Red - 38°C
Black - 32.6 °C

Fish activity again seems to increase w/ shade on shelf (shade from clouds). Sun on shelf when arrived.

1805 hrs - Temp. water 33.9°C
air 29.0°C

Light (shade)
Black — /
Red (water in probe + not register)

1825 hrs. water level - 2.00

Left 1830 hrs. (dark)

Group I

Jan.	♀	♂	?
9	20	15	16
15	17	22	19
13	18	19	14
13	22	18	20
13	16	19	20
14	18	19	18
15	20	21	22
15	18	18	16
15	23	19	18
14			18

Group II

♀	♂	Jan.	?
17	17	11	18
18	19	13	19
18	21	15	
		14	
		14	
		11	
		15	

CJJ 67-11 Nisbet Oxley

Total of Groups I + II

Total length (mm)	Total #	Juv. + Young	♂	♀	?
8	0				
9	1	1			
10	0				
11	2	2			
12	0				
13	5	5			
14	4	4			
15	6	5	1		
16	3			1	2
17	3		2	1	
18	10		2	4	4
19	9		4	2	3
20	4			2	2
21	2		2		
22	3		1	1	1
23	1			1	
	53	17	12	12	12

CJJ
67-12

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

24 September 1967 1140 - 1530 hrs. DST

Carol James & C. W. Ivy

Stopped at Manse Ranch and took measurements for a map of M. R. Pool. see CW Ivy MST #3
Arrived at Devil's Hole at 1140 hrs.
The chain holding the door of the cyclone fence had been broken (link at padlock cut). Lucky Strike pack of cigarettes near the water. Cage damaged - bent severely on the northern end so that the fish could easily swim in and out. Picture taken of damaged cage. Light meter 92

Initial observations:

Weather - Sunny. Wind to 20 mph.
General Condition:
Algae - sparse but covering most areas. Floating algae (which had been replaced last time after activity on the shelf) almost non-existent in most areas - just some minute portions out from western wall. Obvious disturbance.
Scum - little but almost entirely covering the water surface.
Much sulfur smell
No dead animals in water - dispersed

CJJ
67-12

Activity: fish quite active. Many fish swimming in and near edge.

We approached the cage cautiously and and trapped about 35 fish in it by bre-bending the end.

Water level 1.9' (1200 hrs.)
Air temp. 27°C
water temp - 33.5°C
Light
red - .4°C
black - 24.5°C

O_2 - taken at 1300 hrs. 4 ppm

Took measurements of Devil's Hole for map.

Took fish out of cage - measured some: 21, 23, 18, 19, 16, 20, 19 mm but I decided to take all of the fish out of the cage and leave it a week to watch for hatching of any eggs that may have been laid in it. Mostly large adults in cage. no young (side of cage was about 5" above ground level when marked). (Looked like an air tank had been dropped on it. No measure - pictures taken.

1500 hrs - planaria in crevices of rock sides - beetles inactive
- Captured twelve young to take back to NSU - put in 20 gallon plastic tank w/ water from Devil's Hole. Six planaria + two beetles collected

CJJ 67-12

alive also. Handled with as much care as possible. Algae patch added to tank for protection.

Note – small conical snail found on the upper shelf. Probably more present, but we did not have time to look.

Algae stripped because of our activity on the shelf

Left: 1530 hrs.

CJJ 67-13

Carol J James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

1 October 1967 DST 0845 -- 1500 hrs.

C. James, C.W. Ivy, Melissa Armstrong

We stopped by Manse Ranch Spring on the way to Devil's Hole. CW Ivy MST #4.
We left Devil's Hole for several hours during the middle of the day and went to Schoolhouse Spring. We also went to Big or Deep Spring, Pt. of Rocks, + Jackrabbit Springs after leaving Devil's Hole at 1500 hrs.

Initial Observations:

Weather - Partly cloudy but sunny.
Slight wind (→ 15 mph.)
General Condition: Algae fairly sparse.
Scum broken + shifting. No floating algae.

Activity on shelf quite limited during the time we were there. — We used the 4' umbrella (bag) seine in an attempt to get individuals for a sample + for the cage but were only partially successful.

At first, 50 fish on shelf then 75 as scum shifted then 100 fish (@ 10 hrs.) on upper shelf.

No fish in cage when arrived. Algae (except for one large floating piece that had been placed in the cage before) sparse

on rocks.

Fish feeding on grey matter (1930 hrs.)

When we first arrived and before we got into the water, we observed a dying fish (large adult male) apparently natural death. He was first resting on his side on a rock and we thought he was dead. But after about a minute, he flipped a little bit as if trying to erect himself. In doing this, he moved about 1" to the other side of the rock and then lay still for a while more (still on his side). This process was repeated several times until he disappeared several minutes later after we stopped watching for a minute or two. In the process of flipping, he had once almost thrust himself under a rock and it is entirely possible that this is what happened, although we made a rough search for him and could not find him. No planaria or beetles could be observed on or near him. (flipping motion prevented this?)

0900 hrs. — Water level = 1.78
1000 hrs. - O_2 = 4 ppm
1300 hrs. — Water level = 1.82 (light hitting NW edge of water area).

Seining not successful even when seine left in 1½ hrs.
Some of individuals captured were put in the empty (of fish) cage.

CPP 67-13.

Put in Cage – (4)♂ × (1)♀

♂		♀	
#	size	#	size
(3)	17mm	(1)	17 mm
(1)	18 mm		
(1)	15		

Other individuals seined, captured, + released.

mm	young.	juven.	adult ♂	adult ♀
7	1			
8				
9				
10				
11				
12		1		
13		1		
14		1		
15		1?		
16				
17				
18				
19				
20				
21		1		
22				
23		1		

1 pair (not mated)

* Many young and small juveniles on upper shelf – collection data is inaccurate because it does not give an accurate indication of the proportion of young.
* Number of adult females seems to be significantly

reduced - see individ captured for cage & those seined.
Also, dip nets were used to try to get more ♀'s for the cage. Attempts unsuccessful.

Large adult males seen between upper & lower shelves - collected one 26 mm♂ & put in formaldehyde - some larger than this in population.

Adult. Conical snails abundant on shelf.
Hydrophilid found dead in seine - upper shelf.

Measurements of upper shelf taken.

1300 hrs. - Left Devil's Hole.

CJJ 67-16

Carol James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

15 October 1967 0815 - 1010 hrs. PST

C. James + M. Armstrong + C.W. Ivy. + Glen Gold

~~(24 hr. survey at Manse — C.W. Ivy)~~ Manse C.W. Ivy MST 6/

D.H. Initial observations -

Weather: wind - gusts 35-40 mph above + 15-20 in hole area.

clear sky - sunrise was at 0700 hrs.

General Condition - Scum very heavy over upper shelf, dispersed somewhat to see + observe fish, but it recovered the surface quickly. Because of dispersal (throwing water), scum "sank" + shelf rocks covered w/ white. Little value to take pictures. Fair growth of algae. Deep water very clear. No floating algae.

Activity - ~75 fish on shelf but may be more - cannot see clearly. Feeding activity. Quite active.

0815 hrs. - Water level 1.70

Cage - 5 fish still alive + well. No more than 5. No more than 1 ♀.

Algae on cage sides - little on rocks except for floating algae at south-side.

CJJ
67-16

Bees + Moth in Water. Also, large (6-7") scorpion.

Temp.

AIR - 19.5°C

Water - 33.5°C

Planaria active.

Scum dense + good population (75) of fish on shelf until we put the 4 x 4' bag seine in and the scum shifted. Then, the scum dispersed over the entire surface of the water + the fish had to be dipnetted one by one — only 2-4 fish at a time on the seine (small juveniles + large adults only). Activity then very low even though we got completely out of the water for 30-45 minutes.

0910 hrs - Light

12.2 incidence.
6.1 reflected

Fish hide in rocks.

Cage Fish

♀ - 18.5mm

♂ - 16.0, 18.0, 19.0, 19.0 mm

CSS 67-16

mm		♂	♀
9	I		
9.5			
10	II		
10.5			
11	II		
11.5	I		
12	I		
12.5	II		
13	II		
13.5	I		
14	III		
14.5	I		
15			
15.5			
16			I
16.5			I
17		I	
17.5			
18		I	
18.5			I
19.			I
19.5		I	
20			
20.5		I	
21			
21.5			
	16	4	4

Total Sample - 24

Not representative of whole population - many adults at depths.

CSS 67-16

Algae in dr. green mats at lower shelf

1010 hrs - Water level 1.65

Light 12.5 incident
6.8 reflected

Left.

CSS 67-16 Carol J James 1

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

28 October 1967 1420-1750 PDT = PST

C. James + M. Armstrong

(24 hr. survey at Manse – (w log) MST ?

Initial Observations:

Weather – some breeze. Partly cloudy but sunny. Clouds very scattered.
General Condition – No floating algae. Scum covering most of surface broken but heavy. Algae on shelf very sparse.
Water clearer than previously.
Algae still somewhat more in middle section but not heavy

1420 hrs – water level – 2.08

Two pictures taken, both w/ Melissa in Bathingsuit top.
No birds.
Planarians very active - water high + covering much of stand rock.
Beetles on rocks but not very active.
Bees somewhat active.
Beetles copulating
Sun much more at an angle (southern ⅓) – at about 40° ⅓ – unusually low. Sun started on shelf as we

arrived – on extreme west side + progressed across water. ~ 4' section of direct sunlight.
1440hrs – Section in middle of shelf w/ 1-2' shadows on west + eastern sides

~ 100 fish on shelf. Feeding – in formerly referred to "grey" areas but the areas appear light tan now w/ very sparse algae. Schooling in feeding areas – few stragglers elsewhere but – just on extreme western side (along cliff) are three groups of 10-25 fish each.
Majority of fish are adults but there are also juveniles – no young seen (although two small juveniles seen) Bronze coloration noted on some.

1450hrs – sun completely off water's surface. Sun on shelf only ~ 30-35 min.

Measurement of cage fish:

♀ – 19
♂ 16, 19, 19, 20

✓ Three pictures taken of these five fish in an attempt to show their color.
♀ - dark
♂ - light.
No breeding or chasing observed.
Males very light –
One is "albino-looking"
Another is " " but w/ dark fringes on his fins.
Other two are also very light.

Female – dark (as normal) olivaceous except for ventrum which is white.

No young in cage.

Dipnetted Individuals –
moved off of shelf as soon as we entered the water – very hard to capture.

1624 hrs. — Light
11.7 incidence
64 reflected

1630 hrs. — O_2 = 4 ppm.

No young seen – several small juveniles were observed, however. Many large fish got away.

Lower shelf – Many individuals seen 20-30' – small dots against light background. Larger individuals seem to prefer deeper ~~larger~~ depths.

mm	?	♂	♀
8	1		
9	1		
10			
11	1		
12	1		
13	11		
14	1		
15	111		
16		1	1
17			
18			1
19			
20			
21		1	
22			

CJJ 67-16

Not representative sample - larger adults at deeper depths

1630 hrs - O_2 = 4 ppm

Dusk 1750 hrs.

Seven C. diabolis preserved -

measurements not in previous table but are as follows (measured after in alcohol - harder to tell sex.

♂	♀
20 mm	20 mm
19	22
23	24
25	

CJJ 67-17 Carol J James 1

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

12 November 1967 0855 – 1115 hrs. PST

C. James & CW Ivey

Stopped at Manse MST 8/ (before going to D.H.) & put traps in.

Initial observations -

Weather – partly cloudy but sunny.

General Condition – Algae very sparse now in all area - still a little over rocks here; but otherwise just minute covering over all rocks. No floating algae. Scum very reduced, also – a very little is scattered over middle of upper shelf & some is at N & NW edges of Hole.

0855 - (4) pictures taken – as follows:

Charlie in these pictures:
- X – off focus
- 1 – 8 x 100
- 1 – 5.6 x 150

1 – close up 3ft 5.6 x 100

0855 - Water level 1.76

Light 12.4 incident
6.5 reflected

CJS
67-17

0900 hrs ~ 75 fish on shelf. Most adults. Many gathering at "grey" areas which have only a very little algae at them (slight tinge of dk. green). Significant # of juveniles also present. Feeding + milling activity.

Cage — Large mat of algae still in cage although very dark green (& rocks - no algae) Small mats (3×5") of dk. algae also scattered on eastern side of shelf.

0900 hrs — Seem to be more fish on the upper shelf now than 0850-0855. (Fewer at 0850 because of frightening?)
Now can easily count 50 - then could only count 25-30.
Probably 75 - 100 fish on shelf now.
Snails!

Collection — Two large (long handled) dip nets — one w/ large + one w/ small mesh
↗ fish can swim through -
∴ sample smaller than would have been if small mesh net available.

Fish school when frightened. They are easily frightened by any movement at all — are scared down to depths (over ledge) of 6+ ft. + do not readily come back up.

CSS 67-17

mm	Total	?	♂	♀
7	1	1		
8	0			
9	0			
10	4	IIII		
11	3	III		
12	6	IIII I		
13	2	II		
14	6	IIII I		
15	6	IIII I		
16	5	[illegible]	I	II
17	2			II
18	4		III	I
19	2		I	I
20	4		III	I
21	2		II	
22	0			
23	1		I	
24	1		I	
25	0			
26	1			I
27				
	~~30~~	~~30~~ 32	12	10 ~~8~~

Not random sample of entire population — larger fish in deeper water.

Cage — ♀ — 20 mm

♂ — 17, 19, 20, 20.5 mm

males (esp. largest (3)) are iridescent white w/ dark fin stripes.

CJJ 67-17

(all of these are incl. in previous measurements)

Four adults collected + preserved.
Four others were collected + put in a styrofoam cooler to be taken back to NSU.
All of these died + were preserved.
(except two fish - which were too disintigrated)

Female in cage can easily be distinguished from males while in water - very much darker.

1030 hrs. — while Dip netting, we saw a Neotoma lepida come down to the water + drink for several minutes.

1100 hrs. — Water level 1.81

Light — reflection in hole high but no direct sun. Sun about 20° above water on western ledge.

Light - 13.7 incident
8.2 reflected.

CJJ 67-18

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

19 November 1967 0850 - 1100 PST

C. James, C.W. Dorr, M. Armstrong

We stopped at Manse MST 9 (0730 - 0740) and Schoolhouse (0825 - 0845) and dropped traps in each.
Stopped then at D.H. + completed work there before going back to Schoolhouse + then Manse.

Initial observations:

Weather - Complete, dark cloud cover. Heavy rain in some areas, but did not rain at D.H. while we were there (had rained before we arrived, however). Wind slight but cold.
General Condition - Practically no algae on rocks (only a very slight light green tint on rocks, indicating a very thin layer still on) Some small mats of very dark green algae "here + there"
No scum over shelf - very broken over rest of water. (Rained - ∴ dispersed scum)

Activity on shelf - increased above that I've seen on recent visits. Some feeding - most just swimming. No breeding activity or territoriality.
0850 hrs. - count 90 individuals on shelf + estimate 120. A significant # of young juveniles seen - some quite small (~ 11 mm). Many adults over sloping rock. Juveniles concentrated in southern half of upper shelf.

CSS 67-18

0920 – count 150+ now. estimate 175-200 on upper shelf & (Note again - complete dark cloud cover)

No light, temp, or O_2 taken. (No equipment)

0930 – Water level 1.86.

One large individual observed to bury itself partially in the grey silt ("grey matter") and remain there for almost 1 minute + until a smaller fish swam over & (after swimming around it twice) proded it. The larger one swam away immediately.

Collection — done w/ two long handled large dip nets. (Both w/ small mesh).
I quietly got into the water, inched up the extreme top (east) of the large NE sloping upper shelf rock and Charlie placed his net in the western deep channel of the shelf while I dipped as low as I could over the ledge and

Very "scary" – just one sweep of dip net + fish stay below 5' on the western lower slope + lower shelf. They do not come back up even if undisturbed + no disturbance on shelf for ½ - ¾ hr. Individuals on upper shelf will move toward edge of shelf immediately with the slightest movement on the shelf. This is markedly different from behavior observed in the summer – when

the fish seemed unafraid of intruders, even if the intruders are in the water & moving about.

Injured one large ♂ in cage — still swimming but not using caudal fin - just pectorals. Injured while attempting to dip net. Still not normal, but doing fairly well after 45 minutes. Did not attempt any measurements of cage individuals — no more than original 5 (4 ♂, 1 ♀). algae in cage like that on rest of shelf. No breeding activity or territoriality. Males are light. Smallest male is darkest of the four, other males are white w/dark fringes on fins. Female is easily recognized by sight even in water - she is much darker than males (This is characteristic of those on shelf, too - females seem to have retained their summer (normal) color while many males have lost much of their color)

It seems to me, however, that the males on the shelf are no longer majorally white - there seems to be mostly individuals w/ the same darkness as the females. In other words, the majority of males on the shelf & those that can be seen below are no longer very light individuals, but are dark enough that females & males cannot be distinguished easily while in water.

CJJ 67-18

mm	♂	♀
10		
11	////	
12	//// ///	
13	//// /	
14	//// ////	
15	/	
16	//	/
17	///	//
18	//	
19	/	/
20	////	
21	//	
22		
23		
24	/	/
25		
26	/	
27		
	29	16	5

Total - 50

This sample is (not) representative of the population as a whole, because of the larger individuals staying + being frightened to lower depths beyond our reach.

11 + 12 mm (incl. above) w/ S-shaped spine - one of these collected.

1055 hrs. - left

CJJ 67-19

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

30 November 1967 0830 - 1030 hr.

C. James, C. W. Ivy, M. Armstrong.

Initial Observations -

Weather: dark clouds covering most of the sky. (Dry lake bed very wet along rd.) Snow on higher mountains. Wind - (above hole: 20-25 & gusts to 30 mph.) in hole: gusts to [redacted]15 Air temp. above hole = 9.4°C

General Condition: No algae except for small dark green mats which are reduced (even in cage). Only a green tint on rocks. Scum very scattered & reduced (still drifts in groups).

0840 hr. - few fish on shelf
some feeding activity (at grey & lt. tan sandy area on west side of shelf, especially). Fish play against rocks.

Water level - 1.90

No planaria activity. Beetles at surface on rocks. Water temp. = 33.3°C

Count 70 fish - ≥ 70% of these are juvenile and small adults.
about 20 large adults.
a few lt. males but not white-looking.

0900 - O_2 taken (Winkler Method) 5.1 ppm
0950 hrs. Light- $i = 9.8$ light taken after dip netting but approx. same as when we arrived. -
$r = 5.8$

Cloudy & sprinkling

Sample taken by dip netting & is fairly representative of those first observed on shelf. Dip netting w/ long-handled dip nets 1/16" mesh.

0955 - air temp. = 10.4°C
water temp. = 33.2 at USGS water level measurer

Water from deeper areas is warmer -
33.8 - 34 over ledge

Cage - (note - one male injured last time)
Observed 5. much chasing during period when we watched.

In cage:

♂ = 8, 19.5, 20.5, 21.5 mm
♀ = 21.0 mm

Sample from shelf -

Some preserved - these are included in recorded measurements.
Juveniles appear yellow-green. Some iridescent copper.

CJJ 67-19

Total length mm	juveniles	♂	♀
9			
10	𝍸 I		
11	𝍸		
12	𝍸 𝍸		
13	II		
14	𝍸 I		
15	IIII		
16		I	III
17		I	II
18		I (light)	
19		I	I
20			
21			
22			
	33	11	6

Total [45]

CJJ 67-20

Carl J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

23 Dec. 1967 0830 - 1040 hrs. PST

C. James & C.W. Ivey

Initial Observations:

Weather - Clear sky. No wind - very slight breeze occasionally. Air is cold - steam off water. Small snow patch near D.H. Snow on No. - facing slopes of surrounding mountains.

General condition -

Essentially no algae on rocks; 5 or 6 small (largest = ~ 5×6") very dark green patches of algae on shelf.

0830 - O_2 taken - Winkler - 5.3 ppm

AIR Temp. - 6.6°C
Water Temp - (at rock) - 33.2°C
Water level. - 1.75
Light incident - 11.4
reflected - 5.9 no direct light

Count 70 fish — est. 100-110 fish on upper shelf. Rocks very dark so, hard to see fish.

about 80% of these are adults - rest are juveniles - some fairly small juveniles seen, but no young. Most activity is in southern half of shelf.

Scum - very scattered and only over approx. area of the upper shelf.

CSS 67-20

Piece of honey comb in water. Also dead bees in water

In cage - bare rocks. some bunches of dark green algae (the one large piece is smaller than when introduced.)
Some "following" activity shown by three fish - 2 males + 1 female

Two pictures taken (at 4' distance) of upper shelf - w/ my camera at 50 +4 & at 3.5 + <50.
Side of cage included in both pictures.
Hg thermometer broken in water.

Temp. at NE upper shelf rock 33.4°C & increasing near the north ledge.

1020 - incidence light - 12.0
reflected - 6.5
Water level - 1.78

Ten fish seen on sloping shelf (sloping from upper to lower shelf) - this is fewer fish than ever seen before.
Males on upper shelf are light in color, but not as ~~as~~ light as those in the cage.
Twenty-five fish were dip-netted. But most adults missed because they hid in rocks on shelf.

Cage - all alive and well - no disabilities

♂ - 19.5 ; 22.0 ; 21; 23 mm all are lt. grey w/ white dark fringe on fins
♀ - 22.5 mm dark green top w/ silver-white ventrum

CTS 69-20

Total length mm	juveniles	♂	♀
12	11		
13	1111		
14	1111		
15	111		
16		1	1
17		1	
18		1	
19		1	
20		1	1
21			1
22		1 (light color)	1
23			
24			
25			
26			1
	14	6	5

Total - 25

Sample obtained by use of long-handled dip-nets.

CJJ 68-1

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

11 January 1968 0950 - 1155 hrs.

C. James, C. W. Dry, M. Armstrong

Initial Observations -

Weather - clear sky except for some dark clouds at horizon. No wind to gentle wind.

General Condition - No pictures of shelf possible because of scum.
Rocks barren - "grey" matter is now almost white. Fish still picking at it.
Scum - Heavy. Broken & small flakes but w/ light scum in between flakes - giving (from a distance) the shelf a greenish tint as if the algae were growing back. (see. M. Armstrong note - Schoolhouse has luxuriant algae & chara).
Scum over upper shelf area & shifting.

0950 hrs. - O_2 taken (Winkler) - 4.0 ppm
Water level - 1.75 on USGS meter

1000 hrs. - Light (no direct sun - sunlight is half-way down upper wall)

Incidence - 11.9
Reflected - 6.4

CJJ
68-1

Algae, as before, just slight covering on rocks (although perhaps a greener tint than before) w/ small dk. green clumps. Greenish tint to rocks - dk. green at water's edge + metalic green color frequent also at water's edge).
Same in cage.

Cage - 5 fish.

♂ - 20.0, 21.0, 22.0, 23.0 mm
♀ - 23.0 mm

1015 hrs. — Air temp. — 12°C

42 fish in 80. 1/3 of upper shelf
Count 130 on shelf - est 150+ - 170.
Chasing activity + feeding.
Some at top.

1030 hr. - fish hide in rocks - beetles active. Few planaria
Snails present.

More smaller than larger individuals -
Small adults.
Larger individuals toward northern end.
Small fish in shallow end.
Some bees

Two fish preserved - both died during handling +
both included in measurements. (15 + 18 mm)

CJJ 68-1

1150 – Light

Encid. – 12.2
Reflected – 6.7
Water level – 1.80

Total length

mm	Juveniles	♂	♀
10	I		
11	I		
12	II		
13	////II		
14	//// ////		
15	////		
16		I	I
17		II	I
18		II	I
19		II	
20		III	
21		II	
22			
23			
24			
25			I
	24	12	4

Total 170

Sample obtained by dipnetting w/ two large long-handled dip nets.

CJJ 68-3

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

17 February 1968 0930 – 1200 hrs. PST

C. James & C.W. Ivy

Initial Observations:

Weather – Heavily clouded but not completely overcast. Little or no wind.

General conditions –
Still very little algae on shelf – just green (bright, dark green) deposit along water edge (wipe off water measure to read). Some wisps of algae over the light tan silt ("grey matter").
Scum is heavy and had to be dispersed to observe the fish. Scum is yellow-green in color.

0930 hrs. – Count 50 in southern half of upper shelf. I cannot see the northern half well at all, and can only count 20 there. Est. 130 on the upper shelf.

Activity – much active swimming. Much play against rocks. Feeding. Some chasing. I observed no spawning, but I only watched for a few (15-20) minutes. To fish around water meter. Fish constantly active

Light – (camera light meter) – incid 14.1. reflect – 8.5

CJJ
6 8 3

0940 hrs. – water level 1.88 on meter.

AIR Temp. = 17°C

1000 hrs. – O_2 taken w/ Van Doran + fixed by Winkler

O_2 = ppm.

I collected fish at the extreme southern end of the upper shelf while I was standing at the large rock at the water meter. These fish were collected without getting in the water and were measured separately —

mm	♂	♀
12	1	
13	1	
14		
15	III	
Juv.		
16		
17	II	
18	II	II
19	II	I
20		
21	II	
22	IIII	I
23		I
24	I	I
	♂ 13	6
Juv.	5	
Total	24	

Caudal fin on one 22 mm ♂ had been nipped. A 19 mm ♂ had good breeding coloration.

Cage Fish:

(Algae bunches appear greener – not so dark in places) No little ones in cage.

males are still iridescent white.

♂	♀
21 mm	22 mm
23	24*
24	
25	

* original ♀ (can tell easily by coloration which is darker than the newly introduced ♀)

Note: another ♀ was apparently introduced into the cage at an unusually high water level before the last raising of the cage. See CJJ 68-1

Getting into the water and dip-netting resulted in the collection of several more fish. These are recorded as follows and were collected mainly on the northern part of the shelf.

16 ♂ – good blush color – breeding color.

Preserved several specimens incl. those fish dying in second batch due to cold water in styrofoam cooler – all preserved fish are included in the measurements of either batch one or ~~two~~.

QJJ 68.3

mm	juv.	♂	♀
9	1		
10			
11			
12	1		
13	1		
14			
15	111	1 positive ident. by fins only	
16		11	1
17		1	1
18		1	1
19			11
20		11	
21			
22		1	1
23		1	
24			
25			
26			
27			
28			
	6	1/10	6

1200hrs. – Air temp. 19°C

Moderate breeze

Water level 1.80

Light. incid – 15.0
ref. – 9.6

Water temp. at "rock" – 9.4°C (higher?) diff. therm. used

CJJ 68-4

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

1 March 1968 0730 - 1000 hrs PST

C. James & C. W. Ivy

Initial Observations:

Weather - sky clear - no wind.
(sunrise - 0615 hrs.)

OK Took picture of shelf w/my camera - Scum
(taken before disturbance)

General condition -
Scum completely covering surface
except for small whorl in cage. -
Scum quite heavy.
Algae - very slight covering
over rocks. Green-tint in
places & on rocks at water
surface.

0745 - Definite feeding. (lunging at rocks).
Water level - 1.98
Light i = 11.8
r = 6.4

Eight fish at water mark (NW side) - i = 10.5
r = 6.0

Neither beetles nor planaria are active.

0753 hrs. - Had to disperse scum in order to count fish.
Could see only very limitedly. Fish disappear
into rocks. Some chasing observed.

Fish active again less than 5 min. after dispersal.

Count 75 fish on upper shelf - est. 130
(dark rocks - hard to see)
(Majority of fish are in middle of shelf, and I can see them only by movement because of the dark rock background.)

0800 hrs. - much feeding.

Majority of fish appear to be small adults.

Light i = 12.0
r = 6.1

Cage individuals —

♂	♀	
21	22	
~~23~~	24 *	* original ♀
24		
25		

Largest ♂ has fairly good Breeding Colors - others are still iridescent white w/ black fringes on fins.

CJS 68-4

mm	♀	♂	♀
5			
6			
7	II		
8			
9	IIII		
10	II		
11	II		
12	I		
13			
14	I		
15	II		I
16	𝍸	I	III
17		III	I
18		I	
19		I	I
20		II	I
21		III	II
22			
23	14	11	9

Light anal fins on ♂'s.

Males on shelf are fairly well colored.
Malformity seen >0

* Selective capture of little ones near rock.

0945 – Light – i = 12.0
↑ = 6.8
Water level – 1.92

Left 1005 hrs. –

CJJ 68-5

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

22 March 1968 0745-1045 hrs. PST

C. James & C.W. Dry

General Observations:

Sunrise - 0545 hrs.
Light breeze. Cool (~45°-50°F).
Partly cloudy (cirrus clouds overhead + rain front near)

BOK ~~Five~~ pictures taken of upper shelf before disturbed (taken w/ my camera)

Algae - very sparse. Greenish tint only very slight. Color of upper shelf very brownish.
Scum - over entire surface but not quite as heavy as usual. Pictures show scum coagulated spots (w/ light film in between).

0800 hrs. - Much pairing and following seen over NE rock (best view point)
Spawning seen. Three fish close together ♂♂ + ♀(?) and spawning (could not see sex - too far away) then group met two more fish and intermingled and then formed "line" - all close together. Other pairs chasing.

CJJ 68-5

0800 (cont'd)

At same time, in so. half of shelf - great deal of feeding (lunging) on rocks & no chasing *(pair chased into so. half but immediately broke up).

0805 hrs. - Light $i = 13.5$
$r = 8.0$
Water level = 1.87

Planaria active (on surface, too)
Dead moths and insects (bees) in water.

0810 hrs. - Count ~ 30 in so. half of upper shelf (very difficult to count because of scum and dark brown background)

Count 24 in north half of shelf but I can only see those against light background and that is scarce.

Estimate ~ 100 fish on shelf - most seem to be fairly large. (medium + large adults) but may be because of difficulty in seeing.

Most fish seem to be concentrated near NE slope + entire north 1/4 of shelf.

Small fish selectively caught at extreme so. end (shallowest water)

0820 - Beetle fairly active.

CJJ 68-5

Cage –

♀	♂
23 mm	23 mm
24	24
	25
	26

Sample collected w/ long-handled dip nets & then measured & released.

1110 – Light incident – 13.4
reflected – 7.9

Water level 1.88 on scale

1040 – Count 21 (estimate 30) adults feeding on NE Rocky Slope of shelf – This count was made while measuring but before any adults had been released. (captured)

Most of these observed adults had come up from the lower shelf area.

Notes – Some 11-12 mm juveniles look like adult in shape (deep bodied), others of same size look slender like young.

Coloration showing up in sexes – most ♂ are dark blue – ♀ are green.

CJJ 68-5

Two mutants (S-shaped spine) seen & measured.
13 & 21 mm

Total length mm	♂	♀
5	III	
6	II	
7	II	
8	II	
9	I	
10	I	
11	IIII	
12	IIII IIII	
13	II	
14	I	
15	I	
16	I	I
17		
18	III	
19	IIII	I
20		
21	II	I
22	I	I
23		I
24		
25		I
	29	11 6

Total [46] C. diabolis.

CJJ 68-7

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

7 April 1968 14⁰⁰ -- 19⁰⁰ hrs. PST

CJJ 12 hr. survey at Manse Ranch Spring

C. James + Cliff Ferris

General Observations:

Partly cloudy. Wind to 25 mph.
Algal sparse - as in CJJ 68-6
Scum fairly light but covering entire water surface.

No light meter - Manse Daylight Survey
No O_2 taken
Light same approx. as two days ago - CJJ 68-6

1410 hrs. - Water level 1.9'

Count 54 on shelf -
(30 in so. half + 8 at water meter)

Chasing, feeding, spawning observed

No beetle activity
6 Planaria on large rock in water at water meter. I observed a pair of fish spawning on the rock.

1440 - Cliff and I put the 4' umbrella seine in on the north side of the shelf

CJJ 68-7

and left it there while I showed Cliff Schoolhouse + Point of Rocks Springs.

1600 hrs. – Arrived back at Devil's Hole + found 15 fish on the seine with good activity on the shelf (no estimate taken but fish numerous). Seine was ineffective in obtaining a good sample because the population level is not extremely high (as it was when the seine was used successfully – the fish then used various water levels more frequently) and fish almost entirely restrict their movements to the rock surface. The rod frame of the seine and the irregularities of the rocks on the shelf result in the fish going under the seine instead of over it.

Time from approx. 1600 - 1800 hrs. was used dip netting with a 4x6" dip net.

While dip netting, several observations were made as follows:

A large # of adults were frightened over the ledge to the lower shelf, but as time passed + we continued

CJJ 68-7

our activity on the shelf (for 2 hrs.) I noted that the adults hesitated less (after each disturbance) before coming back onto the shelf.
For instance, standing exactly on the ledge + sweeping + moving considerably would drive them down ~ 5 ft. but they would return + go under my feet in less than 5 minutes. Also, immediately upon getting over the ledge to the upper shelf, they started intense feeding.

I counted 50+ large individuals on the sloping ledge but did not have the long-handled large dip nets to capture them —

SAMPLE IS NOT REPRESENTATIVE OF LARGER ADULTS.

One large, dark blue male captured + held in Cliff's hand for 3-4 min. It turned light iridescent. (fright reaction).

CJJ 68-7

Cage individuals

♀	♂
25.5 mm	26.5 mm
24.0	25.0
	26.0
	24.0

Also in cage – one (very active) 12mm.

~ 10 Fish were preserved –

5 of which died accidentally in the holding seine. (juvenile & one 17 mm male)

All of these fish are included in the following table

During measurement, I could easily tell males from females from coloration (even w/ artificial light)

I Noted that 18 mm ♀ seem to be of different body depth.

MALFORMITY – S-shaped Spine (dorso-ventrally)
8 mm young

CJJ 68-7

Use flashlight while measuring + observed several young evidently attracted to the light (attracted to the edge of the light most often).

Total Length mm.	♂	♀
5	III	
6	II	
7		
8		
9	III	
10	IIII	
11	I	
12	IIII	
13	I	
14	IIII	
15	I	III
16		I
17		II
18		I
19		IIII
20		IIII
21		IIII
22		III
23		
24		III
25		II
	26	29

♀
I
IIII
III
IIII
I
I
I
I
I
19

Total - 74

Manse

11 Jan
A.M 10.0 ppm
P.M - 15.8 ppm

DH.

11 Jan. 4 ppm

S. H.

11 Jan 4.5 ppm ✓

DH.

~~1830~~ ? - 5.0 ppm
2. 1820 - 4.8

25 Jan

1100 - ~~5.0~~
0730 - ~~4.3~~
1630 - ~~5.2~~

15
1412
1630
1820

CJJ68-8

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

26 April 1968 0700 - hrs. PST

C. James, C.W. Ivy

0700hrs - We arrived at Devil's Hole approx. 3 minutes after the to date largest H-bomb test at the A.E.C. site and found that an Atomic Energy Com. geologist had been sent to Devil's Hole to record blast effects on water level. His name was Bert Weir and he said that the water level had lowered almost a half a foot and raised 42/100 ft. (according to the U.S. Geol. water meter)

↑

Leupold & Stevens Instruments, Inc.
4445 N.E. Glisan St.
Portland, Oregon 97213

see article by G.F. Worts Carson City

After approx. 20 minutes, there was another brief rising of the level & some tides - without visible cause & surprising Mr. Weir also.

0715hrs. - We placed two sinkers at the lower shelf

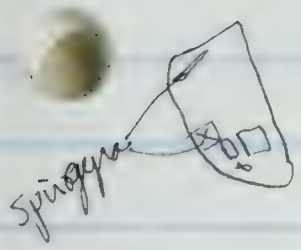
Weather - clear & little wind.
Shelf Condition - Scum fairly heavy. Spirogyra starting to come back; otherwise, complete sand cover over upper shelf.

0730 hrs. - Light $i = 12.6$
$\lambda = 7.1$

Count 31 fish on shelf. Est. 50 active
↗
20 in so. half
Feeding activity.

CJ
68-8

Pictures taken of shelf - sandy w/ algae as indicated (spiroggra)



Exa - 4 pictures (1st 4 of roll)

20K My camera - 3 pictures

1030 hrs. - Water 1.79

Light i = 133
n = 7.8

1040 hrs. - Count 34 Est. 55 on shelf.

Sun on shelf 1230
Sun off shelf 1420

Cage fish —

Original Adults -			Young & Juveniles
♂	♀		F.
24	26	(first female)	8
25	25	(introduced female)	10 } died
26			10 }
26			11
			11
			11
			12
			13
			16 ♀?

Young Juvenile (10 mm) died for no apparent reason - seemingly because I captured most in one medium-sized dip net & they remained somewhat crowded for ~5 minutes.

I otherwise handled them very carefully.
They died in the dip net - before I ever
touched them by hand. Possibly death resulted
from shock of overcrowding or from harassment
by the adults they were with briefly. ?

6 adults (1 lost before measured) were
captured in the trap parallel to the wedge
Measurements of the five are as follows:

♂	♀
20 mm	17 mm
20	21
24	

long-handled dip nets (These are included in the following table.)

Dip netting used to collect sample for measurement

One malformity noted - constricted caudal region +
S-shaped spine - ~~small male~~. 11 mm
One 8 mm fish died
Collection of preserved specimens -

all included in following table.

CJJ 68-8

Total length (mm)	Total #	Young + Juv.	♂	♀
5	3	3		
6	2	2		
7	3	3		
8	8	8		
9	14	14		
10	8	8		
11	6	6		
12	10	10		
13	3	3		
14	7	7		
15	6	4	1	1
16	2		2	
17	2		1	1
18	1		1	
19	1		1	
20	3		2	1
21	5		1	4
22	3		2	1
23	1			1
24	2		1	1
25	1			1
Total	91	68	12	11

Fairly representative?

CJJ
68-9

1

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

17 May 1968 — DST 1600 - 1900 hrs.

C. James, C.W. Ivy, M. Armstrong, J. Reese

Traps run both at Manse + Schoolhouse.

R left in overnite

General Observations. —

Weather - clear, little wind.
scum - oily but light.
Algae + Spirogyra — heavy
Spirogyra especially abundant
in SW portion of shelf.
Algae mats still dark green

10K 3-4 Pictures taken of shelf w/ my camera
2 w/ Exa
(Brown portfolio on water meter
also glasses + clock + light meter)

Light completely off shelf — ~ 1550 hrs.

1600 hrs. — Count 109* fish on upper shelf
Est. 200 - 220 "good"-sized individuals.

* of these 109 counted (remember - this does not include young or small juvenile) 30-35 are adults which are approx 20+ mm long.
- Majority of fish appear to be small adults.

Light i = 14.4
λ = 9.2

CJJ 68-9

no beetle or planaria activity. Bees very active.

Fish very active - quick movements.

Feeding + chasing + spawning observed.

25 fish at surface

Much competition in cage - male after 1 female?

Dip netted a sample from shelf.

One trap lost - remains on lower shelf

Two traps on lower shelf - trapped 7 fish as follows:

♂	♀
12 mm	18 mm	20 mm
	20	23 mm
	21	
	22	

Included in large table

Cage ♂

Male	Female	F1
25 mm	26 mm	6 mm
26	26	6
27		8
28		10
		11
		11
		11
		11
		11
		12
		17 ♀
		21 ♀

J. Reese - note 1 (22 mm) male marked in note as "W." ?

CJJ 68-9

Total length (mm)	Total #	Young + Juv.	♂	♀
5	3	3		
6	1	1		
7	1	1		
8	1	1		
9	7	7		
10	9	9		
11	13	13		
12	14	14		
13	13	13		
14	7	7		
15	7	6	1	
16	10		3	7
17	10		5	5
18	6		4	2
19	6		4	2
20	10		6	4
21	9		6	3
22	7		5	2
23	1			1
24	1		1	
Total	136	75	35	26

CJJ
68-10

Carl J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

30 ~~April~~ May 1968 1515 - 1830 hrs. DST

C. James & C.W. Dry.

Finished Mark Trapping & Measuring before coming to Devil's Hole.

General Observations -

Weather - clear

Scum quite broken but millions of tiny bubbles cover the water's surface over the upper shelf only, making it difficult to see.

Floating algae along extreme SW edge and spirogyra ~~algae~~ algae heavier than two weeks ago.

OK Took picture w/ my camera from upper platform. Sun full on shelf.

1515 hrs. - Put 2 traps on lower shelf (lost trap still visible on lower shelf)

Counted 25 fish on upper shelf but visibility is poor - est. 50.

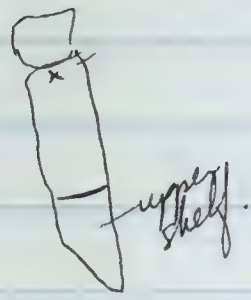
Light (direct sun)

i = 15.2
r = 10.2

Shade start on shelf - 1530 hrs.

CJJ 68-10

A Fish was observed at the North Rock & at the water's surface & near it.



Dip netting for measurement sample.

Cage

♂	♀
25 mm	26 mm
26	~~27~~
27	26 mm
28	

F1

♀
20 mm
24
16?

6 mm
7
7
7
8
8
9
10
10
11
12
13
15
15

Total 23 captured from cage

Pictures (w/ the aquarium set up) were taken of each batch measured by hand in an effort to establish degree of accuracy w/ the photographic technique.

Picture #1 — Traps from bottom

♂	♀
18	20
19	25
20 (dark)	26 ? (pointed fin)

CJJ 18-10

Picture #2 & #3 - Fish from Shelf - dip netted

Picture #2

13, 13, 13, 12, 12, 13, 9, 10, 11, 15, 11, 8, 12, 14, 11, 8 mm

13, 14, 15, 15

not in picture

♀ 20, 19, 18, 16, 28.5 mm

♂ 18, 16 dark, 21, 17 malformed mm

Picture #3

13, 11, 11, 15, 15, 11, 15, 15, 13, 11, 13 mm

♀ 16, 16, 17, 17, 18, 19, 19, 23 mm

♂ 19, 21, 16

(Dead not in pictures - 15, 15, 13 mm)

Left - 1830 hrs.

Malformity - 17 ♂ see above

CJJ 68-10

Total collected of Pictures 1, 2, + 3

+ Observation + measured but escaped (not in picture) + 3 dying

Total length (mm)	Total #	Young + juv.	♂	♀
5	1	1		
6	2	II		
7	1	1		
8	2	II		
9	1	1		
10	1	1		
11	7	IIII		
12	3	III		
13	9	IIII IIII		
14	2	II		
15	9	IIII IIII		
16	5		II	III
17	3		I	II
18	4		II	II
19	5		II	III
20	3		I	II
21	2		II	
22	0			
23	1			1
24	0			
25	1			1
26	1			1
27	0			
28	0			
(28.5)	1			1
TOTALS	64	38	10	16

CJJ 68-12 Carol J. James 1

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

16 June 1968 0615 - 0945 hrs.

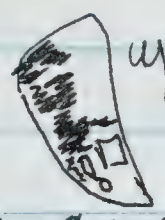
C. James, Cliff Ferris (Daylight Survey at Mouse)

General Observations:

Weather - Fair. Little Wind.

No light meter
No O_2 taken

Scum fairly heavy - little broken.
Algae + Spirogyra are very heavy (see picture taken - my camera - with dipnet in water).
Sunrise on dirt road - 0554 hrs.



See CJJ 68-11

Planaria + Beetles still at water's edge.

0630 hrs - Water level 1.92 on meter

Count 44 fish in so. half of upper shelf
18 fish in no. half

Fish Congregation as noted CJJ 68-11 + several have been captured in the frame - also See CJJ 68-11.

Dip with long-handled dip nets and also collect some fish from two weighted traps placed down at lower shelf for ~ 2 hrs. + some fish found in trap that has been down on lower shelf ~ 4 wks (lost line - traps at ~ 28' depth).

CJJ 68-12

Fish found in trap at lower level for 4 wks. (since 17 May 1968).

? 15, 15, mm

♀ 18, 18, 18, 18 mm

♂ 17, 17, 19, 19, 20, 24, 25 mm

Included in data table

Cage Fish

Original

♀	♂
26 mm	25 mm
26	26
	27
	29

Not in Data Table

F1

Juvenile + Young

9	11
9	11
10	11
10	12
10	12
10	12
10	13
10	14
.	14

Adults

17	♀
18	♀
19	♀
23	♀
25	♀

CJJ 68-12

Collected + preserved fish -

Included in data table

15 ♀
21 ♀
11
9
24 ♂
20 ♂

19 ♀
19 ♀
8
29 ♀

Formaldehyde weak - live fish changed color in it - darkened.

Observed + collected material which was evidently just the outer scale-skin of a fish - covered with about 50 planaria.

Malformity - 8 mm young w/ constricted caudal + S-shaped spine.
included in data table

CJJ68-12

Total Length (mm)	Total #	Juv. + young	♂	♀
4.5	1	1		
5	1	1		
6	0	0		
7	2	2		
8	5	5		
9	1	1		
10	5	5		
11	7	7		
12	5	5		
13	4	4		
14	9	8	1	
15	16	16		
16	6		2	4
17	8		2	6
18	16		2	14
19	14		4	10
20	16		9	7
21	17		9	8
22	5		4	1
23	2		2	
24	3		3	
25	1		1	
26	0			
27	0			
28	0			
29	1			1
Totals	145	55	39	51

CW 68-13

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

6 July 1968 0630 - 1050 hrs.

C. James & CW Levy

(Traps left in Manse Sunrise to Sunset)

General Observations:

11-Compartment Cage put In & Set up.

Weather - clear. gusts to 20mph.

Ladders disturbed & broken somewhat
beer bottles & rocks also show
entrance of people beyond
(inside) gates.

trap: O2
no deep light: on

Spirogyra extremely thick &
covering almost entire shelf.
Observation (especially with dark
background) very difficult.
I Captured many fish by dipping
before entering water. Then
Charlie entered the water at the north
end of the upper shelf & repeatedly
scared the fish back to me as
I dipped them. He also dipped
later. Very successful.

Disturbed Spirogyra made it impossible to
see well after a while. Several fish
were captured at the surface. The disturbed
spirogyra was dipped & searched but
no fish were found in it (apparently).

CJJ 68-13

After dipping with the long-handled dip nets we spent several hours on the shelf working with the new cage + measuring. During this time only a few new fish appeared on the shelf ~15 juveniles + 4 adults

I feel that this capture is a good sample.

Est. ~300-350 fish on shelf before dipping

Old Cage

Not in data table

Original

F,

♂	♀
26 mm	26 mm
27	27
~~29~~	
28	

young + juveniles

5 mm	visual	12 mm
6		13
8		13
9		13
9		13
10		13
10		14
10		15
10		15
11		15
11		
11		

Total in cage 37 fish

adults

16	♀	20	♀
16	♀	21	♀
17	♀	22	♀
18	♀	25	♀
19	♀	26	♀

CJJ 68-13

Compartment Cage – Included in data table

Compartment #	Fish placed in	
1	23 ♂	11, 11, 11 mm
2	23 ♂	11, 11, 11 mm
3	19 ♂	13, 13, 13 mm
4	20 ♂	13, 13, 13 mm
5	20 ♂	15, 15, 15 mm
6	21 ♂	15, 15, 15 mm
7	20 ♂	17, 17 mm ♀s
8	27 ♂	17, 17 mm ♀s
9	21 ♂	22 ♀
	21 ♂	25 ♀
10		
11	22 ♀,	24 ♂
	24 ♀	20 ♂
	24 ♀	
	19 ♀	

CJJ 68-13

Malformities — in data table

13mm — constricted caudal & humpbacked
15mm — S-shaped spine.
8 mm — "

Some ♂ light in color

2 fish in algae mass — preserved along with a good sample of others.
all included in data.

CJJ 68-13

Total length (mm)	Total #	Young of year	♂	♀
6				
7	1	1		
8	6	6		
9	4	4		
10	8	8		
11	6	6		
12	6	6		
13	10	10		
14	6	6		
15	17	16	1	
16	9		2	7
17	23		4	19
18	25		10	15
19	13		4	9
20	28		12	16
21	13		5	8
22	7		0	7
23	9		3	6
24	6		2	4
25	2			2
26	0			
27	1		1	
28				
Total	200	63	44	93

CJJ 68-14

Carl J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

15 July 1968 1350 - 1450 hrs. PDT

C. James & Vera James

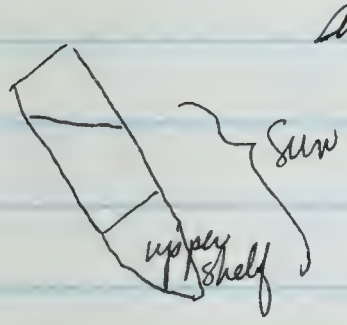
General Observations:

Weather - clear sky, wind to 25 mph.

Shelf condition - Heavy scum and the Spirogyra is very heavy Hard to see any fish

Examination of sectioned cage put in one week ago

No young seen in sectional cage no spirogyra in sections except as noted - additional squared numbers indicate fish captured from shelf, circled numbers indicate fish taken from section II and introduced.



While we were here - scum full on shelf and covering ~ 3/4 of surface of water.

CSS 68-14

Section Number	Condition	Size of fish (in mm)		
1	4 fish	23 ♂	and 11.5, 12, 11 juv.	
2	1 fish	(lost 11mm while measuring and replaced with 22 ♂)		
3	4 fish	19 ♂	14, 13, 13 juv	
4	3 fish	19 ♂	13, 13 juv.	
5	4 fish	21 ♂	15, 15.5, 16.5 juv.	
6	3 fish	22 ♂	15, 15 juv.	
7	2 fish dead - 1 alive	17 ♀	introduced 17 ♀	20 ♂
8	2 ♀ alive male dead but in good condition (27mm) Replaced.	18 ♀ 18 ♀	(25 ♂)	
9	Spirogyra only in this section 2 fish	21 ♂	22 ♀	
10	dead female - unmeasurable 1 live male	19 ♂	(22 ♀)	
11	1 dead	clipped 24 ♀	21 ♀	clipped 23 ♀
		19 ♀	19 ♂	20 ♂

- fish captured from shelf & introduced

@ - indicate fish taken from section 11 & introduced into another section.

CJJ 68-15

Carol J James 1

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

23 July 1968 0640 - 0930 hrs. PDT

C. James + C. W. Ivy

General Observations:

Weather - Partly Cloudy, gentle breeze.

Pictures taken w/ Exa. 4 slides -
nothing extra in pictures except that the floating sectioned cage is also present.
2 of 4 pictures are of the whole shelf, two are close-ups (one of rock & one of area near cage)
Camera - 3.5 - 50

Shelf - Spirogyra is very heavy
Scuma is quite broken but heavy.

Original cage with some spirogyra
(as last week)

No light or O_2 readings taken

Collecting was done with long-handled dip nets and two traps placed on the lower shelf.

Before active collecting done, Est 125 fish on upper shelf.
Many small adults.

CJJ 68-15

Sectioned floating Cage -

Section #	Comment	Size of fish (mm)
1	original ♂ lost	12, (12), 13 [19 ♂]
2		21 ♂, 12
3	♂ dead	[20 ♂] 14, 14, 14.5
4		19 ♂, 14, 13
5	♂ dying & pickled	♀16, ♀16, 15 [25 ♂]
6		20 ♂ ♀16, 15
7		~~19~~ ♂ ♀18, ♀18
8		19 ♂ ♀18, ♀18.5
9		22 ♀ 21 ♂
10	No fish left	[20 ♀]
11		18 ♂ (20 ♂) [21 ♀]

[+] fish captured from shelf & introduced into section

(#) fish transfered from one section to another.

CJS68-15

Original Cage -

Total length (mm)	?	♂	♀
8			
9	1		
10	1		
11	3		
12	3		
13	3		
14			
15	2		
16			5
17			2
18			2
19			1
20			1
21		1	1
22			2
23			
24			
25			
26		1	2
27		2	1
28		1	
Total 35	13	4	17

Deep traps (2) left in from 0700 - 0915 hr.

Trap 1 - one fish (15 mm)

Trap 2 - 0 (open slightly)

Both traps on bottom of lower shelf.

CJJ 18-15

Total length (mm)	Total	?	♂	♀
5	1	1		
6	2	2		
7	2	2		
8	3	3		
9	4	4		
10	3	3		
11	5	5		
12	4	4		
13	11	11		
14	7	7		
15	9	9		
16	4			4
17	9		2	7
18	6		2	4
19	10		4	6
20	16		6	10
21	8		3	5
22	3		3	
23	4		2	2
24	1			1
25	3		2	1
26	1			1
27				
28				
29				
30				
31	1			1
	117	51	24	42

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

27 July 1968 1100 - 1145 hrs. PDT

C. James & Geri Little

This trip was made to alter conditions in the sectioned cage to stop the high mortality rate of adults in the sections.
Picture taken on Shelf — Much algae
I introduced spirogyra (washed as well as possible to avoid introduction of young and eggs) into each section and added another piece of float styrofoam for cover.

1100 hrs. Light $i = 14.7$
$\lambda = 9.1$

Completely overcast - only very light sprinkling.

Good activity - ~150 fish on shelf

I also replaced dead fish in some of the sections -

Sections 1, 5, & 10 - new males necessary

and in section 10, I also added another pair - now there are two males + 2 females
Also in this section, I found an 8 mm young which I removed because I believe that I introduced it while dipping.

Still no young found in any other of the cages - No reproduction yet.

CJJ 68-18

Carol J. James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada

14 August 1968 0630 - 0915 hrs. BDT

C. James, CW Ivy

General Observations - Weather - clear w/ slight breeze.

See 12 Aug 1968, CJJ 68-17 for condition of shelf.

One purpose of this field trip was to measure the reduced # of fish in the stationary cage (see flood catastrophe noted 2 days ago).

Before getting in the water and using long-handled dip nets to collect measuring sample of fish, I observed more juvenile fish than I had seen 2 days ago - Observation contrary to scarcity of juveniles noted 12 August.

In stationary cage

27 ♂
27 ♀
10
11
8
12
21 ♀
19 ♀
21 ♀
21 ♀

CJJ 68-18

Floating sectioned cage -

□ = introduced from shelf

Section	
1	16 ♀, 14
2	15, 15, 22 ♂
3	20 ♂, 16 ♀, 15, 15
4	16 ♀, 15, [23 ♂]
5	17 ♂, 17 ♀, (17 ♂)
6	17 ♂, 17 ♀
7	17 ♂ (:), 17 ♀
8	19 ♀, 18 ♀
9	22 ♂ (21 ♂)
10	20 ♂, 24 ♀, 20 ♂
11	1 ♀ left.

Food - restriction

Pictures taken of flood effects

CJJ
68-18

Collection measurements (some preserved & most returned to water on shelf)

mm	TOTAL	?	♂	♀
8	1	1		
9				
10	4	4		
11	7	7		
12	10	10		
13	10	10		
14	12	12		
15	17	16	1	
16	12		4	8
17	20		3	17
18	15		6	9
19	14		7	7
20	14		5	9
21	12		7	5
22	10		7	3
23	6		3	3
24	9		2	7
25	4		1	3
26	1			1
27	1		1	
	179	60	47	72

Included above

Malformities – S shaped spine 26 ♀
" " 13 mm

Collected – 25♀, 20♀, 19♀,

CJJ 68-19

Carol J James

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

24 August 1968 — 1530 - 1730 hrs. PDT

C. James, CW Ivy, Steve James.

Purpose of trip - re-establish cage population at somewhat near that before catastrophe.

In cage to begin with -

13
15
19 ♂ ← Note (new ♂)
20 ♀
21 ♀
22 ♀
27 ♂
27 ♀

The 13 mm + 19 ♂ above were removed from cage + put in Section II of floating cage.

Fish were added to ledge shelf — to as much approx. 23 July 1968 CJJ 68-15 findings as much as possible.

(23 July contained 26♀, 26♀, 27♂ + 28♂ that I was unable to capture, so I had to substitute 22♂, 26♂, 22♀ + 24♀)

CJJ 68-19

Cage composition —

mm	?	♂	♀
8	1		
9	1		
10	3		
11	3		
12	3		
13			
14			
15	2		
16			5
17			2
18			2
19			1
20			1
21		1	1
22		1	3
23			
24			1
25			
26		2	
27		1	1
	13	5	17

NOTE — This is the first time I have had significant trouble in sexing adults. Some males are noticeably light in color. Show Aquarium needed to sex some.

Male 20♀ & 15mm — severely s-shaped spine & constricted caudal

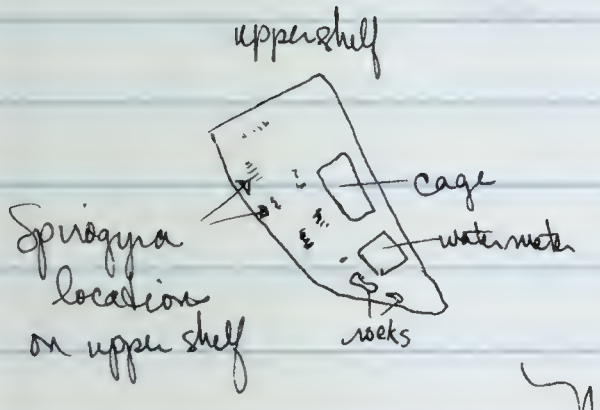
CJJ 68-20

Devil's Hole, DVNM, Ash Meadows, Nye Co., Nevada.

6 October 1968 0640 - 0920 hrs.

C James, CW Ivey, Keir Little

General Observations:



Weather - Clear, no wind
Upper Shelf - Spirogyra sparse. Much deep grey (decaying Spirogyra) and light tan silt covering.

Note - spirogyra sparse & silt condition suggest another sand storm &/or flood since I was last here in August. Later, I noted more large rocks & damage done to the floating cage.

Cage - spirogyra very thick - lining sides & bottom in most places. Algae mats are no longer green - almost black.

Algae mats on shelf are also not green - almost black.
Spirogyra is absent from the extreme so. tip of the shelf area - This area had been untouched by the flood & debris & had had been filled with spirogyra.

CJS 8.20

0655 hrs. (no O_2 or light taken)

Just getting light - not yet sunrise here, but good light.

Can count 93 fish on shelf - limited vision because the floating cage is still present.
Count 69 on south half of shelf.
Est. 160-180 fish visible on shelf.

All sizes of fish - including young & juvenile but only one or two young were seen.

Activity - feeding & following & chasing - suggesting that spawning is still present.

---> "Plowing" behavior (as coined by Bob Lee - UCLA) has not been positively noted before in C. diabolis. However, I observed what I believe is plowing in the deep silt on the western portion of the upper shelf. One fish in particular was seen furrowing in the dirt by diving into the dirt (silt) and following an S-pattern - in two spurts as shown. "Flashing" on dirt is frequent. Other movements suggesting plowing were seen but the movements are just on the surface of the silt - no actual furrow made.

5 mm young seen. - near rock & moving to deeper waters near -

CJS 68-20

Dip netting done w/ long-handled dip nets.

Large cage –

	♀	♂
15 mm	26 slightly s-shaped	27 mm
	25	25
	24	23
	23	22
	21	
	21	
	18	
	19	
	16	

Sectioned cage –

Sect. #1		19 ♂
2		18 ♂, 17 ♂, 23 ♂
3		17 ♀, 17 ♀, 18 ♀, 21 ♂
4		17 ♂, 18 ♀
5		18 ♂, 17 ♀
6		17 ♂ 17 ♀
7		19 ♂ 18 ♀
8		20 ♂ 19 ♀
9		----------
10		21 ♂, 21 ♀
11	?	collected & taken back to NSU

These plus some collected from shelf were taken back to NSU (live).

In sect. 11 total (4 those on shelf) 20♂, 18♂, 21♂, 18♂, 15, 15, 13
14, 12, 22♀, 18♀, 20♀

Three died (those in sect. 11) & were replaced before we left for NSU by 4 fish dipnetted and not measured.

CJJ 68-20

	Juv.	♂	♀	
5 mm	1 (observed)			1
6				0
7				0
8				0
9				0
10	2			2
11	3			3
12	4			4
13	3			3
14	6			6
15	12			12
16		6	3	9
17		8	5	13
18		6	6	12
19		2	3	5
20		3	3	6
21		4	2	6
22			2	2
23		1	4	5
24		1	2	3
25				0
26				0
27				0
28			1	1
	31	31	31	98

Only ones collected + preserved were those dying in sect. 11 of sectioned cage. + those taken live to NSU

Carol J. James 1

Laboratory Aquarium — C. diabolis

24 September 1967 -

1530 hrs Put (12) young Cyprinodon diabolis into prepared 10 gal. aquarium. Aquarium contains plants, & gravel. Filter present, but inefficient. Water temperature according to the aquarium thermometer 85°C. Two fish injured slightly due to handling while transferring to tank. Others seem fine. Six planaria (small two headed (from Devil's Hole) were also introduced into the aquarium.

2100 hrs Checked fish all seemed fine and active. Put in some frozen brine shrimp as feed.

25 September

Water temp - 90°F. according to the aquarium thermometer. This was measured with an accurate centigrade thermometer and a temp of above 34°C was recorded. I reduced the heater level.

26 September

1000 hrs Aquarium temp (registered on inaccurate thermometer) is 84°F. Turned heater up.

Replaced filter, new airstone & more oxygen

tubes. A liquid fry food used in feeding also.

Measurements taken of the fish:

mm (total length)	#
6	1
7	2
8	4
9	2
10	2
11	0
12	1

Total of 12 young.

Temp of water (inaccurate aquarium thermometer) 89°F.

Fish actively swimming.

27 September -

Temp. (inaccurate) - 88 + 89° F.

Activity at 0800 - reduced. Many fish at bottom & inactive.

As day progresses, more activity. 1700 hr - fish quite active. Several observed nibbling at plants. Few fish fairly inactive, but others constantly go up and down the side of the aquarium. Frequent aquarium sides more often than any other area. Activity around

plants also and very little in open water. Constant up and down swimming against glass side of aquarium - gravel, then surface; gravel, then surface (most of the time - although the fish go to the surface do not touch surface with mouth - not feeding or gulping air).

One fish observed in center of aquarium (open water). He swims slowly around in a large circle, keeping fairly level.

No territoriality observed.

28 September

0830hrs Fish quite inactive - one fish is continually going up and down against the (front) face of the aquarium - each time apparently nipping at the bubbles floating at the surface of the water. Once the fish (~13 mm) swam under a plant leaf and it interrupted his ascent - the descent followed (without going to the surface).

Other fish on gravel bottom. Some movement but nearly always for a very short distance only. ~7 times (swim across center line) including one fish probing in the center area, and crossing 3 times (4 fish in the 7 times)

Turned on light in aquarium - movement even of the fish continuously

going up and down stopped and immediately went to bottom and remained there for many seconds. Then the large fish went to the top but did not touch the surface and did not resume up and down movement until I turned the light off a minute later. # of times fish touched the surface then went down the glass all or part of the way to the bottom, then up again) = 33 in one minute - with interruption two additional times by plant leaf. Noted preoccupation with the corner of the aquarium during deep dives.

Biggest (13 mm) fish "playing" by rubbing against rocks!

1430 hrs - Two fish still against aquarium glass & quite active. Others all around plants and quite inactive - feeding - nibbling at plant surface (some food resting on top of plants!

Light left on from 0930 - 1530 hrs

1550 hrs - Still feeding now. Activity moderate around aquarium - Generation, feeding intermittent but not as intense as at 1430 hrs. Some slight schooling noted (3 fish together & later three others - not only for a short time.

Temp. on inaccurate aquarium thermo = 89°F
Accurate clinic thermo = 33.5°C

1 October

0430hrs - One fish found dead in aquarium. Left some but only little food on plant leaves. Put substantial amount of solid food in.

2 October

Two more fish dead now - both found floating on leaf at surface. Predation? (no fungus) Plenty of food left on plant leaves (food now molding). Powder, no liquid food has been put in since 0730 hrs 30 Sept. Other fish seem healthy. Three snails found in aquarium (probably from eggs on plants). Removed.

Fish increased in size, some (2) still small, but other quite large. Can tell sex of those approx. 13mm long. As far as I can tell, of the four individuals I can sex, there are two males and two females.

Planaria observation - one planaria is light tan and very large. Two others observed at what I believe to be sexual reproduction. One individual (which about ½" from the other) suddenly "crinkled" up and remained completely motionless. Meanwhile the other planaria was quite active and several second

later approached the stationary one, just appearing to curl around it, and then unCurling and straightening. Only the posterior portion of the planaria remained crossed and touching. The second planaria "crinkled" also and neither moved for several minutes.
Note - the large planaria mentioned before was about 2" away from this pair and was active (and moving toward them) until the second planaria "crinkled." It did so, and all three became active simultaneously, even though the large single planaria was approx. 2" away from the pair during the time.

3 October

Fungus much heavier - threads several inches long. Cleaned out aquarium completely, sterilizing and using methyl green in substantial quantities. Fish put in gallon jar (w/ some methyl green, air stone, and water) during process.

Only ~~eight~~ C. dubitis removed from the aquarium. I had thought that I had counted nine fish after removal of the plants, so disappearance of the fish may

have been due to human activity. No fungus observed on the fish themselves, and the two smallest individuals are not among these (8) remaining.
Only one planaria collected from the tank before sterilization — put back in aquarium. Will replace w/ more from Devil's Hole this weekend.

School ing noted while fish in gallon jar (typical when disturbed)

Put back in tank — 1615 hrs seem to be all right.
Measured before put back -

10 mm
10 mm
10 mm
11 mm
12 mm
12 mm
13 mm.
13 mm -

1700 hrs. — one fish quite inactive & on bottom - may have been injured.

During course of day the fish have been subjected to a range of temperatures 29.8 — 36.8°C (measured accurately)

and, except for a very slight decrease in activity at these extremes, they have apparently suffered no ill effects.

Thursday, 5 October

Some fungus on sword plant and around edge of aquarium. Other large plant has very fine filaments ~1" long of fungus trailing from the edges of all its leaves. I cleaned it in salt water but all plants have some evidences of fungus. (or algae? - greenish tint when wiped off with kleenex). Used prescribed dosage of Fungistop. But fungus still (5 hrs. late) coming back: appears to be on all plants.

Fish seem to be healthy, however. No evidence of fungus on them.

Cleaned ~~filter~~.

1600 hrs. More fungistop added - ~~filters turned off - left off for night.~~ changed to micro filter

6 October

one fish found dead in aquarium. Can only see five live fish - ~~two~~ of which are quite stationary - one of these, especially, seldom moves at all but just lies on the gravel - breathing slow.

Feed fish 2-3 times a day w/ good

volume of food but it is possible that this is not enough - they readily take food when it is introduced into the tank. Liquifry used (~ 20 drops per feeding) and some small-grained fish food.

Feeding - 1700 hrs (natural feeding time ? - last food put in at 1600 hrs.)

(Six) fish in tank.

The dead fish (12 mm) appeared (was ?) unpigmented

due to hot water ?

SULFA-QUININE + TABLETS PUT IN TANK TO CONTROL FUNGUS

13 October - 1000 hr.

HEATER FOUND UNPLUGGED + HAD BEEN SO SINCE ~0900 12 Oct. - WATER TEMP. = 22.8°C !

ALL SIX SEEM to be alive, BUT VERY INACTIVE EVEN THOUGH LIGHT HAD BEEN LEFT ON ALL NIGHT.

FUNGUS HAS BEEN UNDER CONTROL EVER SINCE SULFA-QUININE USED.

October 20

all (6) fish appear healthy. & notice a differentiation in growth - to be recorded 24 October when they will be measured. Sulfa Quinine is

quite effective in controlling the fungus
I add it about twice a week. -
Fungus is still present, but
I clean it off when it get even
slightly bad and use the sulfa
gilinine. Controled.
Sulfaquinine added at 5:00 P.M.

22 October — 1:00 P.M.

I returned after a weekend
field trip and found that some
~~IDiot~~ had put a large (")
Cichlid in my aquarium to
"grow" it. Saturday night I had only seen in
the aquarium a few minutes, and
all six fish were still alive when
I arrived later - but heaven only
knows what it may have introduced.
One of the two larger fish (the one
that is a dark brown color while
all of the other five are very light
and transparent) looks like it is
dying — it is very slow moving
and rests on the bottom. It
is breathing very rapidly and
seems as if its stomach was
too heavy to stay afloat.

23 October

Fish reported as dying yesterday

found dead this morning. Others appear healthy. Sulfaguanine added again.
All but one of the five remaining fish are quite dark (dark brown) in color. This is the first I have noticed, and internal organs are not as prominent as previously. good coloration

24 October -
Measurements

12	♂
12	♂
12	
13	♀ ?
15	♀

27 October

Five fish still alive in aquarium. but one of them appears very much smaller than the rest. This individual is very transparent and quite inactive - stays close along the gravel.
Other four are also quite transparent - appear lighter & more transparent now than when noted 23 October.

Smallest fish holds himself

at an angle to the gravel - head at gravel with tail + body floating somewhat upward at ~ 35° angle — returns to horizontal position when disturbed and then in a few seconds back to the angular position which he (can) hold for quite a while.

Largest fish has fairly good coloration.

28 October

Smallest fish dying — preserved it. It is very white + small 11mm

1 November

I can see only three fish in the tank now — everything appears normal otherwise. One must have died and be in the gravel.

9 November —

Another fish found dead - 13mm

In formaldehyde - from aquarium

11 mm
10
17
14
13
12

UNITED UNITED UNITED